

Announcement of Recent Acquisitions. . .

HSL No. 71-18

June 18, 1971



THIS ISSUE CONTAINS:

HS-009 108 - HS-009 194
HS-800 430 & HS-800 472
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INTRODUCTION

Publications announced in *Highway Safety Literature* include the most recent additions to the collection of the NHTSA Scientific & Technical Information Service. Subject areas covered include all phases of highway, motor vehicle, and traffic safety, especially those encompassed by the National Traffic and Motor Vehicle Safety Act of 1966 and the Highway Safety Act of 1966.

Individual issues of *HSL* are numbered according to the year and the issue number within that year; thus, 71 designates the year and 1, 2, 3, etc., the individual issues. To aid the user in location citations by the HS-number, the cover bears the inclusive entry numbers for each issue.

Entries in *HSL* are arranged according to the revised NHTSA Subject Category List shown in the Table of Contents. The List is a two-level arrangement consisting of five major subject fields subdivided into 58 subject groups. Documents related directly to the National Highway Traffic Safety

Administration (NHTSA) are announced in a separate section headed NHTSA DOCUMENTS and are numbered in five distinct series: NHTSA Accident Investigation Reports (HS-600 000 series), NHTSA Compliance Test Reports (HS-610 000 series), NHTSA Contractors Reports (HS-800 000 series), NHTSA Staff Speeches, Papers, etc. (HS-810 000 series), and NHTSA Imprints (HS-820 000 series). For NHTSA DOCUMENTS in series HS-600 000 and HS-610 000, individual full case reports are available for inspection at the National Highway Traffic Safety Administration; or for purchase from NTIS (see page ii). Although announced together in a separate section, these documents are also assigned specific subject categories for machine retrieval.

A document which contains a number of separate articles is announced as a complete volume in the subject category most applicable to it as a whole. Entries for the individual articles appear in their most specific subject category.

SAMPLE ENTRIES

Subject Category Array

NHSB Accession no..... HS-800 218 Fld. 5/21; 5/9
Title of document..... AN INVESTIGATION OF USED CAR SAFETY STANDARDS--SAFETY INDEX: FINAL REPORT. VOL. 6 - APPENDICES G-L
Personal author(s)..... by E. N. Wells; J. P. Fitzmaurice; C. E. Guilliams; S. R. Kalin; P. D. Williams
Corporate author..... Operations Research, Inc.

Collation

Publication date..... 12 Sep 1969 150p
Contract FH-11-6921
Report no. ORI-TR-553-Vol-6; PB-190 523

Abstract..... Appendices G-L to this study of used car safety standards include: indenture model diagrams for classes I-IV motor trucks; degradation, wear, and failure data for motor truck classes I-IV; and safety index tables for classes I-IV motor trucks.

Search terms: Wear /Trucks;
Failures /Trucks; Used cars; Inspection standards /Trucks; Inspection standards /Data

HS-004 497 Fld. 5/19

AUTO THEFT--THE PROBLEM AND THE CHALLENGE

by Thomas A. Williams, Sr.

Journal citation ... Published in *FBI Law Enforcement Bulletin* v37 n12 p15-7 (Dec 1968)

Gives figures on the extent of the auto theft problem and comments on antitheft devices available now or in the planning stage.

Search terms: Theft, Theft protection, Stolen cars

AVAILABILITY: NTIS

TABLE OF CONTENTS

NOTE: () Numbers in parentheses following certain subject groups indicate the Highway Safety Program Standards (No. 1, and up) and/or Federal Motor Vehicle Safety Standards (No. 101 and up) which may apply to these groups.

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NOTE: Material published in Highway Safety Literature (HSL) is intended for the information and assistance of the motor vehicle and highway safety community. While brands names, equipment model names and identification, and companies may be mentioned from time to time, this data is included as an information service. Inclusion of this information in the HSL should not, under any circumstances, be construed as an endorsement or an approval by the U. S. Department of Transportation, National Highway Traffic Safety Administration of any particular product, course, or equipment.

AVAILABILITY OF DOCUMENTS AND INSTRUCTIONS FOR ORDERING

Department of Transportation personnel may borrow copies of publications directly from the NHTSA. Outside the Washington, D.C. area, phone (202) 426-2768. In Washington, D.C. area, use government ID, phone 118-62768. Non-DOT personnel should contact their company or agency libraries for assistance.

Journals cited may be obtained through most research libraries.

Contractors' reports and other documents can usually be obtained as indicated under AVAILABILITY. However, there is no certainty that retention copies will be available for more than a limited period after a document is issued.

The more common distribution sources are identified by **symbols** which are explained below:

NTIS: National Technical Information Service, Springfield, Va. 22151. *Order by accession number: HS, AD, or PB.* Prepayment is required by NTIS (CFSTI) coupon (GPO coupons are not acceptable), check, or money order (made payable to the NTIS), *HC* (Paper copy; full size original or reduced facsimile) \$3.00 up; *MF* (microfiche approximately 4x6" negative sheet

film; reader required) \$0.95.

GPO: Superintendent of Documents, U.S. Government Printing Office, Washington, D. C. 20402. Give corporate author, title, personal author, and report number. Prepayment is required by GPO coupon (NTIS [CFSTI] coupons are not acceptable), check or money order (made payable to the Superintendent of documents).

HRB: Highway Research Board, National Academy of Sciences, 2101 Constitution Ave., N. W., Washington, D. C. 20418.

NHTSA: National Highway Traffic Safety Administration General Services Division, Washington, D.C. 20591 (Telephone (202) 426-0874),

SAE: Society of Automotive Engineers, Dept. HSL, 2 Pennsylvania Plaza, New York, N.Y. 10001. Order by SAE report numbers. Prices given are list; discounts are available to members and sometimes to libraries and U. S. Government Agencies. Prepayment is required; orders without payment are subject to a \$1 handling charge.

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WHEN REQUESTING a document, to be absolutely sure you receive what you order, give the accession number (HS, PB, AD number) or report number (in cases such as an SAE document), title of report, and the personal or corporate author (whichever is cited). When requesting an HS-numbered document from NTIS (CFSTI), add DOT/to the prefix HS-; example HS-800 000 should be ordered as DOT/HS-800 000.

1/1 Emergency Services

HS-009 108 Fld. 1/1; 1/2

[BURNS IN AUTOMOBILE ACCIDENTS]

by J. K. Stack

Published in *Trauma* p638-9 (9 Jul 1969)

Comparing 42 fires in front end tank cars with 48 in rear tank cars, the following facts could be established: although front tank cars in Sweden constitute only 20 per cent of all passenger cars, they are responsible for 46 per cent of the fires, 80 per cent of the burns, and 88 per cent of the fatal burns.

Search terms: Fires/Fuel tank location; Accident caused fires/Sweden; Accident caused fires/Burns; Accident caused fires/Injury severity; Burns/Fatalities

1/2 Injuries

HS-009 109 Fld. 1/2; 1/3

IMPACT OF ENVIRONMENT ON ACCIDENTAL INJURIES AND FATALITIES. PROCEEDINGS, 3RD AMA CONGRESS ON ENVIRONMENTAL HEALTH PROBLEMS, CHICAGO, APRIL 4-5, 1966

American Medical Assoc.

1966 128p

The problem of accidents is examined from the point of view of health and medicine. The conference was divided into four panels dealing with the environmental health problem; the medical problem; prevention and mitigation; and accident research. About half the papers presented at the conference deal with aspects of motor vehicle accidents.

Search terms: Accidents/Confer-

ances /Injuries/Environmental factors; Fatalities /Environmental factors; Accident prevention; Accident research; Vehicle accidents; Accidents /Medical factors; Epidemiology /Accident research

AVAILABILITY: Includes HS-003 749; HS-003 835; HS-004 575; HS-004 678; and HS-009 110 to HS-009 114; HS-009 150.

HS-009 110 Fld. 1/2

TYPES OF VEHICULAR INJURIES AND THEIR TREATMENT

by Harold A. Fenner

American Medical Assoc.

Published in *Impact of Environment on Accidental Injuries and Fatalities*, Chicago, 1966, p44-6

Presented to Panel 2: The Medical Problem.

Auto accidents are grouped into three classes: single vehicular accidents involving no sudden decelerative force; vehicle-to-vehicle collisions; and vehicle-to-pedestrian collisions. The injury patterns typical of each class are described. Nine case histories are briefly discussed, involving some 49 fractures which required 31 operations.

Search terms: Injuries by accident type; Accident types /Injury factors; Injury case reports /Fractures; Injury case reports /Surgery; Vehicle vehicle collisions /Injuries by accident type; Single vehicle accidents /Injuries by accident type; Vehicle pedestrian collisions /Injuries by accident type; Deceleration /Injuries by accident type

AVAILABILITY: In HS-009 109

1/3 Investigation and Records

HS-009 111 Fld. 1/3

ACCIDENTS

by J. L. Recht

National Safety Council

Published in *Impact of Environment on Accidental Injuries and Fatalities*, Chicago, 1966, p9-12

Presented to Panel 1: The Environmental Health Problem.

The national accident problem is outlined. Trends in motor vehicle fatalities are compared with those in other types of accidents.

Search terms: Vehicle accidents /Fatalities; Accidents; Fatality rates

AVAILABILITY: In HS-009 109

HS-009 112 Fld. 1/3

PSYCHO-SOCIAL INFLUENCES ON ACCIDENTS

by R. Lomax Wells

Chesapeake and Potomac Telephone Co.

Published in *Impact of Environment on Accidental Injuries and Fatalities*, Chicago, 1966, p26-9

5 refs

Presented to Panel 1: The Environmental Health Problem. Also published in *Archives of Environmental Health* v13 (Oct 1966).

Psychological and social elements have a bearing on accidents. Nineteen behavior traits when contribute to accidents are listed.

Search terms: Behavior /Accident factors; Psychological factors /Accident causes; Sociological factors /Accident causes

AVAILABILITY: In HS-009 109

HS-009 113 Fld. 1/3

RESEARCH DESIGN

by Murray Blumenthal

National Safety Council

Published in *Impact of Environment on Accidental Injuries and Fatalities*, Chicago, 1966, p96-101

6 refs

Presented to Panel 4: Accident Research.

Scientific inquiry begins with problem analysis. The accident toll is the problem; the ideal is the prevention of all accidents. The ways in which the problem can be approached, hypotheses formed, and long range research planned are discussed.

Search terms: Accident research/Scientific method; Accident prevention; Accident research/Design of experiments

AVAILABILITY: In HS-009 109

HS-009 114 Fld. 1/3; 3/2

MEASUREMENT OF HUMAN FACTORS IN ACCIDENT RESEARCH

by Ross A. McFarland

Harvard School of Public Health

Published in *Impact of Environment on Accidental Injuries and Fatalities*, Chicago, 1966, p102-111

23 refs

Presented to Panel 4: Accident Research.

Four major strategies for reducing accidental injuries and deaths are outlined: the control of exposure to hazards; the

consequent to accidents; and the minimization of long term effects of injury through adequate emergency care. Inherent in these strategies are the general epidemiological principles of prevention.

Search terms: Injury prevention; Fatality prevention; Human factors/Accident research; Emergency medical services; Epidemiology/Accident prevention; Hazards/Accident prevention; Environmental factors/Accident research

AVAILABILITY: In HS-009 109

HS-009 115 Fld. 1/3

DEATH AND INJURY ROAD ACCIDENTS IN NORTHERN IRELAND, 1968

Royal Ulster Constabulary

1969? 53p

Statistics are presented on 5,213 death and injury road accidents resulting in 216 fatalities and 7,305 injuries. This represents an increase of 2.3% in fatalities and 3.2% in injuries. Data are included on accidents involving children; time factors of accidents; age factors; accident responsibility; environmental factors; accident causes; motorcycle and pedestrian accidents; rural and urban accidents.

Search terms: Accident statistics/Northern Ireland; Fatalities/Accident statistics; Injury statistics/Accident statistics; Accident rates/Northern Ireland; Children/Accident statistics; Time factors/Accident statistics; Age factor in accidents/Accident statistics; Accident responsibility/Accident statistics; Environmental factors/Accident statistics; Accident causes/Accident statistics; Motorcycle accidents/Accident statistics; Pedestrian accidents/Accident statistics; Rural accidents/Accident

HS-009 116 Fld. 1/3; 5/2

A STUDY OF THE AVAILABILITY AND NATURE OF INFORMATION ON SCHOOL BUS ACCIDENTS RECORDED AT THE LOCAL LEVEL

Maryland State Dept. of Education

1969 51p

This study was undertaken to determine the nature and extent of information available at the local level on school bus accidents involving injury to at least one person. The purpose was to determine whether the causes and effects of the accidents and injuries could be determined. The hypothesis being tested was that such information could not be determined from the data. This hypothesis was confirmed, and recommendations for improvement in data quality are made.

Search terms: School bus accidents/Accident statistics; School bus accidents/Injury statistics; School bus accidents/Accident causes; School bus accidents/Injury causes

HS-009 117 Fld. 1/3; 5/20

MOTOR CARRIER ACCIDENT INVESTIGATION. MOTOR FREIGHT CORP. AND McCORD TRUCK LINES ACCIDENT, FEBRUARY 4, 1969, ADAMS, TENNESSEE

Bureau of Motor Carrier Safety

1969 12p
Report no. 69-3

A tractor-semitrailer combination attempting to pass an auto on an ascending grade collided head-on with another tractor-semitrailer combination, killing both truck drivers and causing about \$45,000 property damage. Reckless driving on the part of the truck driver attempting to pass was deemed the cause

driving regulations, and operating rules of the motor carrier. Both truck drivers were ejected.

Search terms: Truck accidents /Accident investigation; Truck accidents /Head on collisions; Truck accidents /Reckless driving; Accident causes /Passing; Accident causes /Reckless driving; Driver records /Truck drivers; Ejection /Truck accidents; Truck accidents /Fatalities

HS-009 118 Fld. 1/3

VEHICLE ACCIDENT STUDIES. STATE-OF-THE-ART

by K. J. B. Teesdale

Ford of Europe, Inc.

Published in 1970 *International Automobile Safety Conference Compendium* (P-30), New York, 1970, p1266-79

refs

Report no. SAE-700438

Presented at 1970 International Automobile Safety Conference: Detroit, Mich., 13-15 May 1970, Brussels, Belgium, 8-11 Jun 1970.

This paper reviews the main historical, current and future events, problems and trends, significant practices and work in hand regarding vehicle accident studies outside the U.S.A. In general, such studies are under-supported. Two main trends are discernible: short-term, largely politically motivated, national or local demands for quick design-oriented studies and action in certain highlighted areas; longer-term, more realistically motivated demands for truly practical, performance-oriented economic and more permanent solutions in more general areas. Both trends exist side by side and compromise often results. Fourteen conclusions on the state of the

dent studies /International factors

AVAILABILITY: SAE

HS-009 119 Fld. 1/3

INSTRUMENTATION SYSTEM FOR ACCIDENT SIMULATION. WYLE SYSTEMS MODEL 5001. FINAL TECHNICAL REPORT

Wyle Labs.

14 Mar 1969 101p

Contract FH-11-6670

Report no. PB-186 114; 905001-100

An instrumentation system was designed for the Bureau of Public Roads, for measurement of dynamic phenomena associated with full-scale barrier crash testing of passenger vehicles. The system provides seven measurement channels in the test vehicle and instrumentation for seven more channels on the barrier. It was specified that the system be designed to suffer no damage when mounted in a 4,500 pound vehicle impacting a fixed object at 60 miles per hour. It was demonstrated that the instrumentation system was operable with no degradation in performance when subjected to a shock load of 100 g (representative of levels experienced in the trunk of a vehicle impacting a fixed barrier at 60 miles per hour). The instrumentation system and performance test results are described.

Search terms: Barrier collision tests /Instrumentation; Accident simulation /Instrumentation; Vehicle dynamics /Barrier collision tests; Vehicle dynamics /Measuring instruments; Performance tests /Instrumentation

AVAILABILITY: NTIS

North Carolina Dept. of Motor Vehicles

1971 27p

Accident statistics include causes, time factors, age factors, locations, accident types, fatalities, pedestrian accidents, urban and rural accidents.

Search terms: Accident statistics /North Carolina; Accident causes /Accident statistics; Time factors /Accident statistics; Accident location /Accident statistics; Accident types /Accident statistics; Fatalities /Accident statistics; Pedestrian accidents /Accident statistics; Urban accidents /Accident statistics; Rural accidents /Accident statistics; Age factor in accidents /Accident statistics

HS-009 121 Fld. 1/3; 1/2

1969 FATAL ACCIDENTS ON THE STATE MAINTAINED HIGH- WAY SYSTEM

Connecticut Dept. of Transportation

1970 101p

Prepared in cooperation with the Bureau of Public Roads.

Statistics on 249 fatal accidents which occurred on Connecticut's state maintained highway system are presented. Data are included on accident location; time factors; environmental factors; age factors; fixed object and pedestrian accidents; rural and urban accidents.

Search terms: Accident statistics /Connecticut; Accident location /Accident statistics; Time factors /Accident statistics; Environmental factors /Accident statistics; Age factor in accidents /Accident statistics; Fixed objects /Accident

1969 ACCIDENTS OF CLASS I MOTOR CARRIERS OF PASSENGERS

Bureau of Motor Carrier Safety

[1970] 8p

Statistics from 1,521 reports of accidents resulting in fatalities, injuries, or property damage of \$250 or more, and reported by 93 carriers, are tabulated. Tables are given for types of accidents, total fatalities and injuries, age of driver/preventable types of accidents, and day of week/hour of day. There was a continued improvement of the safety record.

Search terms: Accident statistics/Buses; Accident types/Buses; Accident rates; Injury rates; Driver age; Age factor in accidents/Drivers; Accident rates/Day of week; Accident rates/Time of day

HS-009 123 Fld. 1/3

POLICIES AND PROGRAMS. [TRAFFIC ACCIDENT DATA PROJECT REPORT]

National Safety Council, Chicago, Ill. Traffic Accident Data Project, N26400

[1969] 32p

This report presents an approach to broadening the scope of traffic accident reporting by police without adding appreciably to the total task. Essentially the concept proposed by TAD Project is one under which reporting would be undertaken in two stages, basic and supplementary. The term "bi-level" was adopted to give the system a descriptive identification. Samples of accident report forms are included. Problems in coding and processing data are mentioned.

Search terms: Accident report forms; Accident investigation; Police reports; Police traffic services/Accident in-

vestigation /Data processing; Bi-level accident investigation; Police traffic services /Bi-level accident investigation

HS-009 124 Fld. 1/3

TRAFFIC ACCIDENT FACTS. 1969

Wyoming State Highway Dept.

[1970] 88p

This report has been prepared to present various statistics on motor vehicle traffic accidents that occurred on Wyoming streets and highways during 1969. It is based on the 13,229 accidents reported to the Wyoming State Highway Department during that year. This represents an increase of 7.8 percent over 1968. There were 221 fatalities for the year. The death rate per hundred million vehicle miles was 7.6 for 1969. Historical data back to 1965 had been included in many of the charts and tables so that comparisons can be made of present accident experience to that of recent years.

Search terms: Accident statistics/Wyoming; Fatalities/Wyoming; Accident rates/Wyoming; Fatalities /Vehicle mileage; Injuries /Wyoming; Vehicle registration /Wyoming; Accident types/Wyoming; Fatalities /Age factors; Fatalities /Sex factors; Fatalities /Males; Fatalities /Females; Injuries /Age factors; Injuries /Sex factors; Injuries /Males; Injuries /Females; Driver records/Wyoming; Accident causes /Wyoming; Accident statistics /Day of week; Accident statistics /Time of day; Vehicle mileage /Day of week; Rural accidents/Wyoming; Urban accidents /Wyoming; Adolescent drivers /Statistics; Highway mileage/Wyoming; Accident statistics /Annual reports

HS-009 125 Fld. 1/3

COAGULOPATHY IN PREGNANT WOMAN FOLLOWING CAR ACCIDENT

Published in *New York State Journal of Medicine* v69 p1196-1198 (1 May 1969)

11 refs

A case report of coagulopathy which developed in a woman in midpregnancy following a car accident is presented. The condition was recognized promptly and a hysterectomy was performed. In addition a splenectomy was performed because that organ had been ruptured in the accident. The outcome was successful.

Search terms: Coagulation/Pathology; Pregnancy/Coagulation; Splenic rupture/Automobile accidents; Medical case reports

HS-009 126 Fld. 1/3

DEVELOPING EMERGENCY MEDICAL SERVICES. GUIDELINES FOR COMMUNITY COUNCILS . . . STARTING POINTS FOR COMMUNITY ACTION

by I. E. Hendryson

American Medical Assoc.

18p 9 refs

Guidelines for developing emergency medical services are presented under the following headings: the emergency medical services council; community evaluation; and planning for better emergency care.

Search terms: Emergency medical services /Community support; Emergency medical services /Organizations; Emergency medical services /Evaluation; Emergency medical services /Planning

2/0 HIGHWAY SAFETY

2/4 Design and Construction

HS-009 127 Fld. 2/4; 1/4

NATIONAL CONFERENCE ON

RAIL-HIGHWAY GRADE CROSSING SAFETY, FEB 11-13, 1969. PROCEEDINGS

Illinois Univ. Highway Traffic Safety Center

1969 245p

Sponsored jointly by Highway Research Board, and Dept. of Transportation, Washington, D. C.

This conference considered and discussed problems significant and pertinent to rail-highway grade crossing safety. It sought to provide an improved basis for the resolution of these problems by combining efforts of local, state and federal agencies, railroad companies, motor vehicle operators, and research agencies. Panel discussions included: new aspects of grade crossing safety from research and industry, federal government activity, and interagency relations. Workshops were conducted in accident reporting and investigation, traffic operations, enforcement, administration and payoffs in grade crossing programs, including a cost-benefit analysis.

Search terms: Railroad grade crossings /Conferences; Accident locations /Railroad grade crossings; Railroad grade crossings /Safety programs; Railroad grade crossings /Benefit cost analysis; Federal state relationships /Railroad grade crossings; Local government /Railroad grade crossings; Government industry cooperation /Railroad grade crossings

HS-009 128 Fid. 2/4

DEFENSES IN THE BATTLE FOR ROAD SAFETY

Anonymous

Published in *Better Roads* v41 n1 p7-12 (Jan 1971)

Safety measures that contribute to high-

way safety are presented in three parts: part 1 discusses governmental and private programs in the field, as well as various protective devices to keep the vehicle from danger; part 2 discusses measures used to make the highway safer or guide the motorist to his destination; part 3 points out that while research is necessary, it aims for tomorrow, and what is needed is action today.

Search terms: Highway safety /Highway design; Highway safety programs /Federal role; Highway planning; Impact attenuators; Highway safety programs /State planning; Barriers; Rumble strips; Attention /Electronic devices in vehicles; Mobile inspection stations; Pavement surface texture /Skid resistance; Controlled access highways; Traffic operations program to increase capacity and safety; Highway safety programs /Community support; Sign design

3/0 HUMAN FACTORS

HS-009 129 Fid. 3/0; 3/4

HUMAN FACTORS IN ROAD ACCIDENTS

Anonymous

Published in *World Health Organization Chron* p205-11 (Oct-1969)

A symposium on human factors in road accidents is reviewed. Driver behavior; influence of drugs; illness and stress; environmental factors; and licensing procedures are discussed briefly.

Search terms: Human factors /Conferences; Human factors /Accident causes; Drug caused accidents; Driver physical fitness /Accident causes; Stress (Psychology) /Accident causes; Environmental factors /Driver behavior; Driver license standards /Accident causes

3/1 Alcohol

HS-009 130 3/1; 5/6; 3/7

CARBON MONOXIDE AND DRUGS IN FATAL AUTOMOBILE ACCIDENTS. DADE COUNTY, FLORIDA, 1956-1968

by Joseph H. Davis

Miami Univ., Fla.

[196-] 13p 11 refs

The utilization of simple toxicological laboratory procedures as a routine adjunct to the investigation of driver fatalities has indicated that alcohol is the intoxicant most frequently found. Carbon monoxide, as a major cause of fatal accidents, remains relatively insignificant when compared to alcohol. There remains, however, a definite need to investigate the prevalence of occurrence of low levels of carbon monoxide as well as the physiological effects of such low levels when coupled with alcohol, drugs and natural disease. Drugs are occasional findings as far as routine ultraviolet spectrophotometric analysis is concerned. With the widespread utilization of tranquilizers and other drugs, there is need for application for additional chemical procedures as part of routine testing. There is an even greater need for intensive police investigation of the scene and the background of the driver to determine the probable presence and types of drugs in order to direct laboratory investigation into more profitable channels. Limited studies indicate that approximately 9 to 13 percent of drivers killed in single vehicle fatal accidents can be shown to have a chemical in the blood other than alcohol or carbon monoxide. There is a need to establish, within a few selected areas of the United States, laboratory and investigative expertise for in-depth laboratory, epidemiological investigation, and correlative study of the prevalence and influence of drugs on drivers.

Search terms: Driver fatalities /Toxicology; Carbon monoxide /Driver fatalities; Drugs /Driver fatalities; Alcoholic beverages /Driver fatalities;

3/1 Alcohol (Cont'd.)**HS-009 130 (Cont'd.)**

Motorcycle operator fatalities/Blood alcohol levels; Pedestrian fatalities/Blood alcohol levels; Driver fatalities/Blood alcohol levels; Drinking drivers/Age factors; Medical case reports/Driver fatalities; Blood carbon monoxide levels/Driver fatalities; Drug effects/Synergism; Tobacco/Driver fatalities; Spectroscopic analysis/Autopsies; Chemical analysis/Autopsies; Driver fatalities/Accident investigation

HS-009 131 Fld. 3/1**WISCONSIN ACCIDENT FACTS FOR 1968**

Wisconsin Motor Vehicle Dept.

1969 33p

In this annual summary, selected highway crash data are presented, for the most part, without interpretation or comment. In some instances, notice may be taken of trends and relationships which appear to be especially significant. In addition to information available from routine accident reporting, a summary of the results of the 1968 blood testing program is presented; test reports for pedestrians over 16 years of age and for deceased drivers are included. A table of estimated monetary costs of highway crashes by county is shown.

Search terms: Sex factors in accidents; Injuries/Wisconsin; Accidents statistics/Annual reports; Accident statistics/Wisconsin; Blood alcohol levels/Annual reports; Blood alcohol levels/Coroners; Pedestrian fatalities/Blood alcohol levels; Driver fatalities/Blood alcohol levels; Accident costs/Wisconsin; Accident types/Wisconsin; Accident statistics/Month; Accident rates/Wisconsin; Males/Accident statistics; Females/Accident statistics; Accident

tors/Accident statistics; Rural accidents/Wisconsin; Urban accidents/Wisconsin; Traffic control/Accident statistics; Time of day/Accident statistics; Day of week/Accident statistics; Accident factors/Wisconsin; Age factor in accidents/Wisconsin; Fatalities/Wisconsin

3/4 Driver Behavior**HS-009 132 Fld. 3/4; 4/7****ADDITIONAL STUDIES ON DRIVER INFORMATION PROCESSING. FINAL REPORT**

by J. W. Senders; J. L. Ward

Bolt, Beranek and Newman, Inc.

15 Apr 1969 96p
Contract CPR-11-5096
Report no. BBN-1738; PB-184 499

The adequacy of an uncertainty model giving information densities of the road for the Bryar Motorsport track has been examined and reasonable results were found. The hypothesis that there might be a constancy of distance traversed during visual occlusion, irrespective of speed was found untenable. Two different conditions involving changes in vehicle handling characteristics were explored, but no statistical significance was reached. Preliminary studies have been undertaken to explore a mixed mode of operation in which the driver controls both speed and period of occlusion while driving under normal traffic conditions. Analyses of the resulting numerical data have provided some hypotheses about the process. It is suggested that studies be undertaken involving simultaneous use of control measures and visual measures to determine the extent to which these may be independent: one of the visual load, and the other of the control load imposed on the driver.

Search terms: Driving task analysis; Driver task models/Mathematical

handling/Attention; Vehicle handling/Driving tasks; Driving tasks/Vision; Driving tasks/Data analysis; Driving tasks/Speed; Loading (operator performance); Test tracks/Driving task analysis

AVAILABILITY: NTIS

HS-009 133 Fld. 3/4; 2/9**DRIVERS AND ROAD SIGNS**

by G. Johansson; F. Backlund

Published in *Ergonomics* v13 n6 p749-59 (1970)

The function of the road sign system as an information channel for car drivers was investigated. The data were gathered from more than 5,000 car drivers stopped after passing a road sign on a Swedish highway. The main results are as follows: The overall probability of a road sign being noticed on passing is not higher than about 0.5; The different signs studied form a scale of recording probability of perception extending from a low group with a probability of being perceived of about 0.25 up to a group with probabilities between 0.60-0.75. The rank order of the signs is consistent between occasions; The results verified the outcome of a previous investigation by Johansson and Rumar, 1966. The main conclusion must be that the road sign system to a high degree does not achieve its purpose.

Search terms: Sign recognition/Driver performance; Sign recognition/Environmental factors; Sign effectiveness/Evaluation; Signs/Perception; Driver characteristics/Sign recognition; Highway communication

HS-009 134 Fld. 3/4; 3/6; 3/5**MODIFYING NEGLIGENT DRIVING BEHAVIOR THROUGH WARNING LETTERS. AN ABSTRACT**

Sacramento C03000

Aug 1969 16p
Report no. RR-30

From the standpoint of collision reduction and cost/benefits, a warning letter program was clearly supported by the study findings. The experimental low threat letters and the DMV standard letter were more effective than the high threat letters in reducing collision frequency, and all letters resulted in fewer collisions than the no-letter control group. The findings did not support sending a short questionnaire with the warning letter. A reinforcement letter issued to subjects who maintained "clean" records was only effective on those subjects who initially received the Low Threat/Highly Personal letter. Although the warning letters had some impact on subsequent convictions, the effect was smaller than with collisions and did not vary by type of letter. To achieve a maximum amount of collision reduction, it is recommended that a Low Threat/Low Personal letter be used for all female drivers and married male drivers under 30, whereas the Standard letter should be used for all other drivers. It was also recommended that a pilot reinforcement program be adopted and evaluated before making a final decision regarding a reinforcement program.

Search terms: Negligence/Driver behavior research; Warning letters/Driver improvement measurement; Reinforcement (Psychology)/Driver improvement measurement; Questionnaires/Driver improvement measurement; Warning letters/Benefit cost analysis; Accident prevention/Warning letters; Male drivers/Warning letters; Female drivers/Warning letters; Marital status/Warning letters

HS-009 135 Fld. 3/4; 3/6; 3/5

MODIFYING NEGLIGENT DRIVER BEHAVIOR THROUGH

California, Dept. of Motor Vehicles,
Sacramento C03000Jul 1969 71p
Report no. HPR-PR-1 (6) B0114

From the standpoint of collision reduction and cost/benefits, a warning letter program was clearly supported by the study findings. The experimental low threat letters and the DMV standard letter were more effective than the high threat letters in reducing collision frequency, and all letters resulted in fewer collisions than the no-letter control group. The findings did not support sending a short questionnaire with the warning letter. A reinforcement letter issued to subjects who maintained "clean" records was only effective on those subjects who initially received the Low Threat/Highly Personal letter. Although the warning letters had some impact on subsequent convictions, the effect was smaller than with collisions and did not vary by type of letter. To achieve a maximum amount of collision reduction, it is recommended that a Low Threat/Low Personal letter be used for all female drivers and married male drivers under 30, whereas the Standard letter should be used for all other drivers. It was also recommended that a pilot reinforcement program be adopted and evaluated before making a final decision regarding a reinforcement program.

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HS-009 136 Fld. 3/4; 2/9

DRIVER INFORMATION RE-

ROUTE GUIDANCE SYSTEM

by John W. Eberhard

Serendipity, Inc.; Voorhees (Alan M.)
and Associates, Inc.Feb 1969 300p refs
Contract FH-11-6805
Report no. PB-183 599; TR-301-69-12

The Electronic Route Guidance system (ERGS) is based upon a concept for furnishing a driver with individual information inside his vehicle to enable him to accomplish a trip to his specific destination efficiently and safely. ERGS would provide guidance information at each instrumented intersection. The role of this study is to identify the driver information requirements, determine the optimal display characteristics for the required information, and evaluate user acceptance of this particular method of furnishing route guidance information. Driver information requirements were derived from analysis of the guidance needed at an intersection; information needs by identifying the generic network characteristics and drivers' tasks at intersections; time factors were also analyzed.

Search terms: Electronic Route Guidance System/Intersections; Electronic Route Guidance System/Time factors; Guidance systems/Driving task analysis; Driving task analysis/Intersections; Consumer acceptance/Guidance systems; Display systems/Guidance systems; Vision/Driving task analysis

AVAILABILITY: NTIS

3/5 Driver Education

HS-009 137 Fld. 3/5

MOUNTING A SAFETY OFFENSIVE WITH DEFENSIVE DRIVING

3/5 Driver Education (Cont'd.)

HS-009 137 (Cont'd.)

(April 1970)

A statement by the governor of North Carolina presents the history and future of driver education in the state. Emphasis of the courses was on defensive driving. Acceptance of the program was marked. Attitudes toward driver improvement courses were enhanced.

Search terms: Driver improvement schools/North Carolina; Defensive driving/Education; Driver education/Public opinion; Driver education/Acceptability; Driver education/Attitudes

3/6 Driver Licensing

HS-009 138 Fld. 3/6; 3/9

DRIVER LICENSING GUIDELINES FOR MEDICAL ADVISORY BOARDS RELATING FUNCTIONAL ABILITY TO CLASS OF VEHICLE

by Michael S. Stock; William O. Light; Frederic D. Burg; John M. Douglass

Environmental Control Administration

1969 43p 17 refs
Report no. PHS-1996

Criteria for medical advisory boards have been developed along functional and symptomatic lines rather than along pathological and anatomic classifications. The criteria include: alterations of consciousness, cardiovascular function, hearing, mental condition, musculoskeletal performance, respiratory function, and vision.

Search terms: Medical advisory boards/Driver license standards; Handicapped drivers/Driver license standards; Cardiovascular responses/Driver license standards; Hearing/Driver license standards; Driver mental fitness/Driver license standards; Mus-

standards; Respiratory system/Driver license standards; Driver vision standards/Driver license standards; Blackouts/Driver license standards; Driver physical fitness/Driver license standards

HS-009 139 Fld. 3/6

NEW DOT DRIVER QUALIFICATIONS

by Ernest G. Cox

Published in *Fleet Owner* v65 n6 p68-71, 110, 120, 124

The part of the motor carrier safety regulations dealing with driver qualifications has been amended. Disqualifying physical disabilities are now spelled out. Road tests and written examinations will be required for new drivers. Medical examinations will be required. The standards will be considerably strengthened. A list of 100 sample questions is included, from which new drivers will have to be tested before employment.

Search terms: Driver license standards/Professional drivers; Driver physical examination/Driver license standards; Driver disqualification/Professional drivers; Driver tests/Driver license standards; Driver license examination/Professional drivers

3/12 Vision

HS-009 140 Fld. 3/12

DYNAMIC VISIBILITY OF MOTOR VEHICLES

by Akira Yamanaka; Minoru Kobayashi

Mitsubishi Heavy Industries Ltd.; National Research Inst. of Police Science

Published in *1970 International Automobile Safety Conference Compendium* (P-30), New York, 1970, p631-43

6 refs

Includes summaries in French and German. Presented at 1970 International Automobile Safety Conference: Detroit, Mich., 13-15 May 1970, Brussels, Belgium, 8-11 Jun 1970.

Three experiments were conducted under various road conditions to obtain optimum forward visibility standards. Tests were made with a bus, a truck, and a passenger car. An oscillograph measured items relating to driving performance, time, speed, and acceleration, and a polygraph measured psychogalvanic response. Test results were analyzed in terms of eye angular velocity, and it was found that the optimum lower visibility closely connected with 2 rad/sec of eye angular velocity.

Search terms: Measuring instruments/Visibility; Eye movements/Visibility; Reaction time/Visibility; Driver performance/Visibility; Time factors/Visibility; Galvanic skin response/Visibility; Speed/Visibility; Acceleration/Visibility; Automobile design/Visibility; Truck design/Visibility; Bus design/Visibility

AVAILABILITY: SAE; also in HS-007 859

HS-009 141 Fld. 3/12; 2/5

VISIBILITY OF OBJECTS AGAINST DARK BACK-GROUNDS WITH STREET AND VEHICLE LIGHTING

by A. Fisher

Published in *Australian Road Research Board 4th Conference Proceedings, Melbourne*, v4 pt1 p936-60 (1968)

19 refs

Photometric data obtained in streets lighted to the Standards Association of Australia Street Lighting Code are reported. Using the concept of revealing power, it is shown that the visibility of pedestrian-like objects viewed against the road surrounds can be poor. The use of

enhance this poor seeing in a limited range of situations and will generally adversely affect the visibility potential throughout a whole street lighting installation. It is suggested that headlight practice be modified to reduce glare from that source, and that street lighting practice be modified to enhance visibility in streets with intrinsically dark surrounds. The concept of multi-level lighting is introduced to replace the single minimum level of the S.A.A. Code.

Search terms: Visibility /Vehicle lighting; Visibility /Street lighting; Street lighting standards /Australia; Pedestrian visibility /Street lighting; Headlamp standards; Headlamp glare; Highway lighting mounting height; High level lighting; Low beamed headlamps; Photometry /Street lighting

HS-009 142 Fld. 3/12; 5/13

TECHNICAL COMMITTEES EXAMINE DRIVER REAR VISI- BILITY

Anonymous

Published in *SAE Journal* v77 n11 p48-9
(Nov 1969)

Mean minimum gap acceptance by drivers in lane changing is greater when using plane fender mirrors than with convex mirrors. Change in the distance to a following headlight display is detected earlier when viewed through a plane mirror than through a convex mirror. Glare discomfort has a perfect negative correlation with reflectivity. Under test conditions, mirrors with reflectivities of up to 40% produce acceptable glare. A table rating the user acceptability of the convex interior mirror is displayed.

Search terms: Convex mirrors /Lane changing time; Distance perception /Convex mirrors; Lane changing time /Plane mirrors; Distance perception /Convex mirrors; Following di-

stance /Convex mirrors; Glare tolerances /Rearview mirrors; Reflection /Rearview mirrors; Convex mirrors /Consumer acceptance; Rear visibility; Gap acceptance /Convex mirrors; Gap acceptance /Plane mirrors

4/0 OTHER SAFETY-RE- LATED AREAS

4/7 Mathematical Sciences

HS-009 143 Fld. 4/7; 5/4

ESTIMATION OF COMPONENT LIFE USING STRESS DISTRIBUTION PARAMETERS

by Miroslav Hanke; Stephen L. Bussa

UVMV-Motor Car Research Inst.; Ford Motor Co.

1970 16p 12 refs
Report no. SAE-700034

Presented at Automotive Engineering Congress, Detroit, Mich., 12-16 Jan 1970.

Determination of component fatigue life under cyclic loading with variable stress amplitudes is a problem of high interest for the automobile engineer. This paper is a theoretical study showing that the factors influencing the value of the expected life can be specified by the choice of a convenient mathematical formulation of the loading spectrum shape, of the S-N curve slope, and of an appropriate cumulative damage law. The final equation proved to be suitable for graphical presentation, which allowed construction of a very general nomograph for rapid informative calculations and thus allowed time for further quantitative analysis of the influence of every considered parameter separately as well as for the formulation of requirements on the accuracy of their determination.

Search terms: Fatigue life /Mathematical analysis; Nomographs /Fatigue life; Stress /Fatigue life; S-N curve

AREAS

(forces) /Mathematical analysis; Stress measurement /Parameters

AVAILABILITY: SAE

4/8 Transportation Systems

HS-009 144 Fld. 4/8; 4/1

HIGHWAYS, HIGHWAY SAFETY, OTHER TRANSPORTATION

Anonymous

Published in *State Government* p64-65
Winter 1969

The bulk of transportation legislation concerned drivers, motor vehicles, and highways, although some states earmarked funds for urban mass transportation and air travel projects. Legislative activity in all of these areas is summarized.

Search terms: Transportation regulation; Driver behavior /State laws; Implied consent laws /Kentucky; Insurance costs /California; Alcohol laws /California; Motorcycle laws /California; Motorcycle laws /Colorado; Motorcycle laws /Delaware; Alcohol laws /Georgia; Point systems /Georgia; Implied consent laws /Georgia; Transportation planning /State laws; Billboards /Oklahoma; Bridge inspection /Ohio; Restraint systems /New York

5/0 VEHICLE SAFETY

HS-009 145 Fld. 5/0

THE MATURING OF SAFETY INTO AN ENGINEERING DISCI- PLINE

by Paul L. Wickham; Robert L. Moore

North American Rockwell Corp.

1968 7p
Report no. SAE-68066

4/8 Transportation Systems (Cont'd.) HS-009 145 (Cont'd.)

Engineering and Manufacturing Meeting, Los Angeles, Calif., 7-11 Oct 1968.

The increased use of equipment both within and outside industry and the increased complexity of the equipment have heightened the requirement for system safety, that is, the assurance that products will perform their intended functions with optimum safety within the constraints of operational effectiveness. This paper traces the growth pattern of industrial (workman) safety concepts, demonstrates that a similar growth pattern is being followed by system safety requirements, and establishes the importance of safety in the design process as part of the over-all system safety concept. Also presented are brief descriptions of specific engineering techniques which can be used by the design engineer to achieve safety in product design.

Search terms: Industrial safety; Systems engineering/Safety; Safety engineering; Engineering/Safety design

AVAILABILITY: SAE

HS-009 146 Fld. 5/0

PLAN FOR USED MOTOR VEHICLE SAFETY STANDARDS DEVELOPMENT

by Neil Classon

Institute of System Sciences, Inc., Bellevue, Wash, 132100

30 Aug 1968 32p

In order to allocate resources, it is necessary to determine what significant factors, in order of priority, lead to fatalities involving used motor vehicles. A system analysis using the fault tree

Search terms: Vehicle safety standards/Priorities; Vehicle safety standards/Systems analysis; Used automobile standards/Systems analysis; Used automobile standards/Priorities; Trees (mathematics)/Systems analysis; Used automobiles/Fatalities

5/1 Brake Systems

HS-009 147 Fld. 5/1

TRAVELING DYNAMOMETER—A NEW CONCEPT IN RATING BRAKES

by Alvin M. Fischer; Herschel J. Anservitz; William T. Deibel

Mack Trucks, Inc.; North American Rockwell Corp.; Eaton Yale and Towne, Inc.

1968 18p
Report no. SAE-680581

Presented at SAE National Combined Farm Construction and Industrial Machinery, Powerplant, and Transportation Meetings, Milwaukee, Wis. 9-12 Sep 1968.

The conception and development of rating brakes are outlined. This is related to the snub method of rating brakes as described in SAE Recommended Practice J880 and proposes an alternate continuous drag test method utilizing a dynamometer adapted to a road vehicle.

Search terms: Brake tests/Dynamometers

AVAILABILITY: SAE

HS-009 148 Fld. 5/1; 5/20; 4/1

SKID CONTROL: IT'S THE LAW

Anonymous

Published in *Commercial Car Journal* v121 n1 p76-7 (Mar 1971)

Administration's new safety standard for truck and bus brakes is so stiff that anti-skid equipment will probably be required. Tractor trailer compatibility problems with both the anti-skid devices and electrical connections are anticipated.

Search terms: Anti-skid devices/Brake standards; Tractor trailers/Compatibility; Electric systems/Brake standards; Anti-skid devices/Compatibility; Electric systems/Compatibility

5/2 Buses, School Buses, and Multipurpose Passenger Vehicles

HS-009 149 Fld. 5/2

BUS SAFETY

by T. J. Mulcahy

Dublin Dept. of Local Government

Published in *Conference on Road Safety Vol. 2*, Brussels, 1968, A16-1 through A16-39

51 refs

Abstracts in English, French, Dutch, and German.

Four specific bus safety problems are considered with particular attention to school buses, namely—driving visibility; identification of the vehicle when stopped or slowly moving; seats and seating accommodations; emergency evacuation. An examination is made of how best the latest research findings, especially the U. C. L. A. test results, might be applied economically by a government regulatory body to a bus safety program. The role of government in the safety field, both nationally and internationally, is discussed and policy guide lines indicated.

Search terms: School bus safety/Standards; School bus overtaking

view; School bus safety /Visibility; School bus passengers /Statistics; School bus safety /Eye position; Windshields /Visibility; Windows /Visibility; School bus safety /Rear visibility; School bus safety /Convex mirrors; School bus safety /Federal role; School buses /Standardization; School bus safety /International factors; School bus safety /Rearview mirrors; School bus safety /Signs; School bus safety /Signals; Pedestrian characteristics /Speed; Seat design; Seat assembly anchorages; Seat standards; Rear facing seats; Seat backs; Children /Buses; School bus passengers /Occupant rescue; School bus accidents /Fires

5/4 Design

HS-009 150 Fld. 5/4; 2/4; 1/3

AUTOMOBILE AND HIGHWAY DESIGN

by Roy Haessler

Chrysler Corp.

Published in *Impact of Environment on Accidental Injuries and Fatalities*, Chicago, 1966, p69-74

Presented to Panel 3: Prevention and Mitigation.

Design features of automobiles and highways relate to accidents and to the severity of injuries. Factors briefly discussed include roadside hazards, tire failure, occupant protection devices, improved windshields.

Search terms: Automobile design /Accident factors; Highway design /Accident factors; Automobile design /Injury severity; Highway design /Injury severity; Tire failure caused accidents; Roadside hazards /Accident factors; Occupant protection; Windshield design /Injury severity; Windshield covered injuries

HS-009 151 Fld. 5/4; 5/6

WHY DETROIT IS DOING A DOUBLE TAKE ON THE WANKEL

by Jan P. Norbye

Published in *Popular Science* v198 n1 p54-5, 112 (Jan 1971)

The automotive industry's interest and action regarding the use of the Wankel engine is discussed. In addition to the emission requirements imposed by federal regulation, other considerations for its adoption are: lower labor costs; low weight; and ordinary metal needs. Engineering drawings are included.

Search terms: Wankel engines /Automotive industry; Wankel engines /Emission standards; Wankel engines /Costs; Wankel engines /Materials; Wankel engines /Engineering drawings

HS-009 152 Fld. 5/4; 4/7

COMPUTER-AIDED DESIGN APPLIED TO A MODEL OF CHASSIS TYPE STRUCTURE USING FINITE ELEMENT TECHNIQUES

by R. Ali; J. L. Hedges; B. Mills

British Leyland Motor Corp. Ltd; Birmingham Univ.

Published in *Institution of Mechanical Engineers Proceedings 1969-70* v184 pt2A n1 p15-24

19 refs

Includes discussion by T. H. N. Brodgen and author's reply.

The finite element technique has been used for the examination of a chassis-type structure. A computer program was developed to predict the static and dynamic behavior of frames. The program is quite general but its use has been

production car chassis was made in perspex. Nodal displacements of the model, in bending and torsion, natural frequencies and corresponding mode shapes were predicted by the computer program and confirmed experimentally in the laboratory. Several coarser idealizations of the model were examined to study the effect on the accuracy of predictions and the computation time.

Search terms: Chassis design; Computerized test methods /Frames; Finite element method /Laboratory tests; Static tests /Frames; Dynamic tests /Frames; Frame tests /Bending; Frame tests /Torsion; Scale models /Frames

HS-009 153 Fld. 5/4; 4/7

THEORETICAL INVESTIGATIONS INTO PLAIN BEARINGS WITH GAP GEOMETRY UNDER DYNAMIC LOAD

by G. Schaffrath

Siemens A. G.

1970 17p 5 refs
Report no. SAE-700718

Presented at Combined National Farm, Construction and Industrial Machinery and Powerplant Meetings, Milwaukee, Wis., 14-17 Sep 1970.

For the dynamically loaded journal bearing of arbitrary cross section, the method described in this paper allows calculation of displacement curves of the shaft center in the bearing clearance area as well as the calculation of the stiffness and damping coefficients. The bearing may be either a full one or one having one or more axial grooves. The inlet pressure of the lubricant in grooves, if existing, has been assumed zero. Some examples show the influence of the groove arrangement on the displacement curves. Comparisons with experimental results complete the discussion.

5/4 Design (Cont'd.)

HS-009 153 (Cont'd.)

loads; Damping; Stiffness; Oil pressure /Loads (forces); Equations of motion /Bearings; Shafts /Displacement; Bearings /Lubricants

AVAILABILITY: SAE

HS-009 154 Fld. 5/4; 5/2

TRANSVERSE ENGINES—THE FIRST DECADE

by E. G. Bareham

British Leyland Motor Corp. Ltd.

Published in *Institution of Mechanical Engineers Proceedings* v184 pt2A n4 p55-85 (1970)

Several buses with transverse power units were the first to exploit this principle in modern production quantities. A survey is made of the development of the fore-and-aft engine position used in the majority of vehicles today, and the reasons for changing this well-established arrangement are discussed. The B. M. C. Mini design is discussed. Other rear-engined power units such as the Leyland Atlantean bus are described. Pros and cons of the various design approaches seen in the various car applications are discussed, particularly critical design areas such as power unit mountings, gear control, driveline flexibility. There is no overall ideal design solution. While the transverse engine is still regarded as unorthodox, it has established itself as a sound engineering proposition for cars and buses.

Search terms: Rear engine vehicles /Vehicle design; Rear engine automobiles /Automobile design; Rear en-

HS-009 155 Fld. 5/4

DESIGN FOR PRODUCT SAFETY

by M. F. Biancardi

Employers Insurance of Wausau

1970 9p 6 refs

Report no. SAE-700679

Presented at Combined National Farm, Construction and Industrial Machinery and Powerplant meetings, Milwaukee, Wis., 14-17 Sep 1970.

Formal organization and technical considerations for product safety are the best means of eliminating or reducing products liability. The design department and the specific safety methods it uses are highly significant in achieving product safety. Establishing responsibility and accountability for safe design provide motivation and direction. Understanding of the product safety system, as well as application of loss potential analyses, aid safe design. Written documentation of safety analyses and of tests will record findings and aid decision making.

Search terms: Product safety /Safety design; Product safety /Manufacturers liability

AVAILABILITY: SAE

HS-009 156 Fld. 5/4

TAKING THE MATERIALS APPROACH TO A CAN-AM CHASSIS

by Lawrence F. Looby; Robert S. McKee

Armco Steel Corp; McKee Engineering

1970 11p 5 refs

Report no. SAE-700056

Presented at Automotive Engineering Congress, Detroit, Mich., 12-16 Jan 1970

Armco/McKee Can-Am car is not short in its mechanical innovations, but the program objective was to demonstrate the merits of special aircraft steels and titanium in a road racing vehicle. The design advantages gained in the use of these very high specific strength and specific modulus materials are shown. Their use in future racing cars will be more in the area of highly stressed components, rather than complete vehicle concepts. Their use in passenger cars will also be in highly stressed components and will depend upon the emphasis placed on power/weight ratios of specialty vehicles.

Search terms: Racing automobiles /Steels; Racing automobiles /Titanium; Racing automobiles /Performance characteristics; Racing automobiles /Chassis design; Automobile materials /Steels; Automobile materials /Titanium; Weight to power ratio /Automobile design; Stress (mechanics) /Steels; Stress (mechanics) /Titanium

AVAILABILITY: SAE

HS-009 157 Fld. 5/4

THE EFFECT OF ELEVATED TEMPERATURE EXPOSURE ON RESIDUAL STRESSES

by R. W. Diesner

Sundstrand Aviation

1969 7p 7 refs

Report no. SAE-710285

Presented at X-Ray Fatigue Division, SAE Fatigue and Evaluation Committee, Ann Arbor, Mich., 23-24 Sep 1969.

Shot peening is commonly used to create residual compressive stresses in part surfaces, thereby reducing the effects of tensile service loads and improving

subjected to temperatures up to 800 degrees F for times to 4,000 hours. Residual stress measurements were made by X ray diffraction methods. It was shown that residual stresses are not significantly relieved in 52100 within 10 hours at 400 degrees F, or 4,000 hours at 300 degrees F. For H-11, no change was produced within 10 hours at 800 degrees F or 4,000 hours at 600 degrees F.

Search terms: Residual stress measurement/Steels; Shot peening/Steels; Fatigue life/Steels; Tensile strength/Steels; High temperature/Steels; X ray diffraction/Residual stress measurement; High temperature/Residual stress measurement

AVAILABILITY: SAE

HS-009 158 Fld. 5/4

CYLINDER HEAD GASKETS FOR HIGH PEAK PRESSURES

by G. S. Teucher; F. Stecher

Goetzwerke A. G.

1970 12p 10 refs
Report no. SAE-700025

Presented at Automotive Engineering Congress, Detroit, Mich., 12-16 Jan 1970.

Development of cylinder head gaskets to meet the requirements of high-powered supercharged or multifuel diesel engines is described. Problems discussed relate to such critical factors as material, movements at the sealing surfaces, correlation with engine design, and useful life and dependability. These factors and others are carefully applied to the final gasket product, the use of which is proving to be wholly satisfactory in diesel engine operation.

Search terms: Cylinder pressure; Diesel engines/Gaskets; Gaskets/Per-

AVAILABILITY: SAE

HS-009 159 Fld. 5/4

GENERAL LAYOUT CHARACTERISTICS AND PERFORMANCE OF A NEW WIND TUNNEL FOR AERODYNAMIC AND FUNCTIONAL TESTS ON FULL-SCALE VEHICLES

by Alberto Morelli

Istituto della Motorizzazione

1971 7p 10 refs
Report no. SAE-710214

Presented at Automotive Engineering Congress, Detroit, Mich., 11-15 Jan 1971.

Advantages are discussed of closed type and open type working sections of a wind tunnel designed for aerodynamic tests on full-scale vehicles. Analyses of economic considerations, component efficiency, and applicability to the specific purpose of testing were the deciding factors in choosing the open type working section for this wind tunnel being erected by Pininfarina at Torino, Italy. Preliminary design work and supporting research are described.

Search terms: Aerodynamic configurations/Automobile design; Wind tunnels/Automobile tests; Test facilities/Wind tunnels

AVAILABILITY: SAE

5/6 Fuel Systems

HS-009 160 Fld. 5/6

FORMATION AND COMBUSTION OF CARBON IN A DIESEL ENGINE

by I. M. Khan

C.A.V. Ltd.

Presented at Symposium on Diesel Engine Combustion, London, 7-9 Apr 1970. Paper 3.

The effects of the shape of the injection diagram, injection period, and injection nozzle on diesel engine smoke have been studied for a wide range of injection timings and engine speeds on a 1-litre direct injection type engine cylinder. Cycle temperatures were also varied by raising inlet air temperature and by introducing water mixed with diesel fuel. An analysis of these results shows that the exhaust smoke level is mainly determined by the concentration of soot at the end of heat release (net soot release), i.e., any subsequent combustion of the net soot release before exhaust valve opening is unimportant. The net soot release in a diesel engine cylinder, for a given fuel, is controlled by the amount and rate of diffusion burning and the flame temperatures.

Search terms: Diesel engines/Fuel injection; Smoke/Diesel engines; Smoke/Fuel injection; Fuel mixtures/Diesel fuels; Engine operating conditions/Diesel engines; Soot/Diesel engines; Combustion rate/Diesel fuels; Combustion rate/Soot; Flame temperature/Soot; Carbon/Diesel engines; Carbon/Combustion

AVAILABILITY: SAE

HS-009 161 Fld. 5/6

THE MEASUREMENT OF THE VISCOSITY STABILITY OF MULTIGRADE ENGINE OILS AND ITS EFFECT ON PERFORMANCE

by W. W. Crouse; G. W. Wilkins

Sun Oil Co.; Aberdeen Research and Development Center

1970 8p 8 refs
Report no. SAE-700668

5/6 Fuel Systems (Cont'd.)

HS-009 161 (Cont'd.)

Presented at National West Coast meeting, Los Angeles, Calif., 24-27 Aug 1970.

It is shown that the measurement of the viscosity stability of multigrade engine oils containing different VI improvers is dependent upon the shearing action of the test instrument. Mechanical rather than cavitation stresses must be used to obtain an accurate prediction of field performance. Car make as well as average engine speed influence the equilibrium viscosity of the used oil. The effect of shear stability on other performance characteristics of the multigrade oil are described.

Search terms: Oils/Viscosity; Viscosity/Stability; Oils/Shear stability; Stress measurement/Oils; Oils/Performance characteristics; Engine operating conditions/Oils; Stress (mechanics)/Oils

AVAILABILITY: SAE

internal combustion engines have been investigated. Spectroscopic techniques have been used to directly record the time rate of formation of nitric oxide in the immediate vicinity of a flame front propagating through a high pressure combustion vessel. The results presented represent initial experiments for which hydrogen and air were employed as fuel and oxidizer. Similar work with hydrocarbon-air and hydrocarbon-air-diluent mixtures is now in progress. Measurement of spectral absorption due to the (0,0) gamma band of nitric oxide has yielded formation rates for nitric oxide in the vicinity of the flame front. These measurements have shown that nitric oxide formation occurs primarily in post flame gases.

Search terms: Air pollutants/Nitric oxide; Internal combustion engines/Air pollution; Spectroscopic analysis/Exhaust gases; Laboratory tests/Nitric oxide; Kinetics/Nitric oxide; Flame propagation/Nitric oxide; Combustion chambers/Nitric oxide

tion and gas chromatographic analytical techniques. The inconsistencies in the test method as applied to motorcycles are pointed out and suggestions are made for further studies.

Search terms: Motorcycles/Exhaust emission tests; Carbon monoxide; Carbon dioxide; Nitrogen oxides; Infrared analyzers/Exhaust emissions; Ultraviolet analyzers/Exhaust emissions; Flame ionization detectors/Exhaust emissions; Gas chromatography/Exhaust emissions

HS-009 164 Fld. 5/6

COOPERATIVE EVALUATION OF TECHNIQUES FOR MEASURING HYDROCARBONS IN DIESEL EXHAUST

by T. O. Wagner; J. H. Johnson

Coordinating Research Council, Inc.

1971 22p
Report no. SAE-710218

Presented at Automotive Engineering Congress, Detroit, Mich., 11-15 Jan 1971. Prepared in cooperation with American Oil Co. and Michigan Technological Univ.

Methods available for measuring hydrocarbons in diesel exhaust were evaluated by the CRC-APRAC Program Group on Diesel Exhaust Composition during 1967-1970. Early tests showed distressingly large variations from instrument to instrument and undesirably large variations among repeated measurements by one instrument. Instrument quality and operator competence were better in later tests and agreement among instruments was relatively good and errors within instruments were small. Current techniques appear acceptable for engineering measurements. No further cooperative work is planned by CRC at present, but techniques for measuring hydrocarbons in diesel exhaust will be reappraised periodically.

HS-009 163 Fld. 5/6

REPORT ON THE DETERMINATION OF MASS EMISSIONS FROM TWO-CYCLE ENGINE OPERATED VEHICLES

by H. J. Wimetete; R. T. VanDervier

Olson Labs., Inc.

23 Jan 1970 12p
Report no. PB-194 145

Two-cycle spark ignited motorcycle engines are evaluated for exhaust emissions from the standpoint of both concentration (percent) and mass (gms/mile) according to current and projected federal testing procedures for light duty vehicles (under 6,000 pound GVW). Seven two-cycle and one four-cycle motorcycle were tested for carbon monoxide, carbon dioxide, hydrocarbons, nitrogen oxide and di-

HS-009 162 Fld. 5/6

KINETICS OF NITRIC OXIDE FORMATION IN HIGH PRESSURE FLAMES

by H. K. Newhall; S. M. Shahed

Wisconsin Univ.

23 Feb 1970 32p 8 refs
Grant AF00582

Supported in part by Gulf Oil Co. Submitted to the Combustion Inst. for the 13th Symposium (International) on Combustion.

The principal oxide of nitrogen pollutant found in the exhaust gases of automotive internal combustion engines is nitric oxide. The kinetics of the formation of the pollutant nitric oxide under condi-

engine exhaust emissions; Exhaust emission measurement /Hydrocarbons; Gas analyzers /Diesel engine exhaust emissions; Gas analyzers /Accuracy; Exhaust emission measurement /Evaluation

AVAILABILITY: SAE

5/9 Inspection

HS-009 165 Fld. 5/9

MOTOR VEHICLES: POINTS TO WATCH. PERIODIC INSPECTIONS DURING THE FIRST HALF OF 1969

Svensk Bilproving, A. B.

Published in *Technical Aspects of Road Safety* v40 p4.1 through 4.9 (Dec 1969)

During this period, more than 850,000 private cars and 55,000 lorries were inspected. Three-fourths of the private cars received remarks for various kinds of faults. The remark frequency is higher for the lorries than for the private cars. More than 80% of the lorries inspected during the first half of 1969 were remarked on. The principal part of the report deals with statements of the remarks on the 1966 models of private cars. The statistics comprise 110 different makes and types of private cars which have been controlled for the first time in 1969. For each type of vehicle the occurrence of defects is stated for 15 components which often have been remarked on at the inspections, and a comparison is made with the average private car. It appears from the report that certain types of cars have a considerably higher remark frequency than other ones. There are good reasons to assume that at least the more obvious differences in the remark frequencies between the different makes of cars depend upon differences of reliability or durability of, the separate components.

Search terms: Inspection records /Defective vehicles; Inspection records /Defects; Automobile models /Inspection records; Trucks /In-

spection records

5/10 Lighting Systems

HS-009 166 Fld. 5/10; 5/20

WHERE TRUCK LIGHTS GO WRONG

by Charles A. Slater, Jr.

Published in *Commercial Car Journal* v120 n6 p88-90 (Feb 1971)

An equipment maker blames truck light failures on corrosion, premature bulb failure, and poor electrical connections. Selection of the proper materials will avoid corrosion; sockets that protect bulb filaments from shock and vibration, temperature-compensated voltage regulators, extra heavy duty bulbs, and protection from temperature drops would avoid many bulb failures; and use of double wall shrink tubing to seal all wire connections would avoid many electrical system failures. Use of extra heavy duty bulbs, as well as road dirt on the outside of the lamp may distort the lamp lens.

Search terms: Electric system failures /Materials; Electric system failures /Joints; Electric system failures /Trucks; Lamp failures /Trucks; Lamp housings /Corrosion; Lamp failures /Temperature

5/13 Mirrors and Mountings

HS-009 167 Fld. 5/13

WHAT'S AHEAD FOR REAR-VIEW MIRRORS

Anonymous

Published in *Journal of American Insurance* v47 n1 p21-3 (Jan-Feb 1971)

The Dunlap report on rear vision is reviewed. The Smith periscope is mentioned as finally receiving serious notice. Suggested systems include closed circuit TV; rotating mirrors; fiber optics; and various combinations of plane and convex mirrors.

Search terms: Rear viewing devices; Rear visibility /Closed circuit television; Rear visibility /Periscopes; Plane mirrors /Rear visibility; Convex mirrors /Rear visibility; Fiber optics /Rear visibility; Rotating mirrors /Rear visibility

5/15 Propulsion Systems

HS-009 168 Fld. 5/15

WHY THE WANKEL ENGINE IS GETTING A BIG PLAY

by Clare Cotton

Published in *Ward's Auto World* v7 n2 p10-3 (Feb 1971)

The performance characteristics of the Wankel engine are described. Some of its advantages over the traditional auto engine are: smaller size, fewer moving parts, adaptability to automation, lack of vibration. Its emission performance is also discussed.

Search terms: Wankel engines /Performance characteristics; Wankel engines /Engine size; Wankel engines /Vibration; Wankel engines /Automation; Wankel engines /Emissions

HS-009 169 Fld. 5/15

NEW YORK CITY IS TESTING LOW-POLLUTION VEHICLES FOR LONG-TERM URBAN SERVICE

Anonymous

Published in *SAE Journal of Automotive Engineering* v79 n3 p48-50 (Mar 1971)

Turbine powered cars, vehicles burning alternate fuels, and vehicles with catalytic converters are all part of a comprehensive program to develop low pollution vehicles for New York City's car and truck fleet and for taxicabs.

Search terms: Turbine engines /Performance tests; Catalytic convert-

5/13 Mirrors and Mountings (Cont'd.)

HS-009 169 (Cont'd.)

ers /Performance tests; Fuels /Performance tests; Air pollution control devices /Fleets; Air pollution control devices /Trucks; Air pollution control devices /Taxicabs; Air pollution emission factors /New York (City); Air pollution control /New York (City)

factors; Petroleum industry /Economic factors; Fuel taxation /Revenue; Electric rates /Taxation

AVAILABILITY: SAE

HS-009 171 Fld. 5/15

A NEW ZINC-AIR FUEL BATTERY SYSTEM

by Hideo Baba

Sony Corp.

1971 8p

Report no. SAE-710237

Presented at Automotive Engineering Congress, Detroit, Mich., 11-15 Jan 1971.

A new zinc-air fuel battery system using pulverized zinc as its fuel is described. The pulverized zinc fuel is suspended in an aqueous KOH electrolyte, which serves as the carrier of the fuel, and is sequentially fed into each cell of the battery stack intermittently. The method of feeding fuel to each cell is fully detailed. The used fuel and the electrolyte of this new battery system can be removed from the battery and regenerated externally by an electrolytic process without any loss of zinc or electrolyte. Details of the construction and performance of two prototypes of this fuel battery system are presented. Energy densities and fuel capacities are described.

Search terms: Zinc air batteries /Electrolytes; Battery design /Zinc air batteries; Zinc /Fuels; Energy densities /Zinc air batteries

AVAILABILITY: SAE

5/17 Safety Defect Control

HS-009 173 Fld. 5/17

by Don C. Janess; Howard K. Manning

Allen Electric and Equipment Co.; Birtcher Corp.

1970 11p 6 refs

Report no. SAE-700666

Presented at National West Coast meeting, Los Angeles, Calif. 24-27 Aug 1970.

An automatic diagnostic system is described, capable of diagnosing malfunctions in diesel powered vehicles. Diagnosis of fuel system, charging system, starting system, and cooling system can be accomplished by a relatively unskilled operator. The diagnostic system implements new design techniques which greatly reduce the possibility of damage to both test equipment and the vehicle under test. Silicon strain gauge technology is also discussed; it has been found ideal for automotive analysis. Transducers have been developed and tested for a wide range of installations including diesel fuel injection pumps. Static through very high frequency data are illustrated over an operational life of greater than 100 million cycles.

Search terms: Diesel engines /Measuring instruments; Diesel engines /Test equipment; Diesel engines /Fuel systems; Diesel engines /Cooling systems; Starting /Diesel engines; Engine failures /Diesel engines; Strain gauges /Silicon; Transducers /Fuel pumps

AVAILABILITY: SAE

5/18 Steering Control System

HS-009 173 Fld. 5/18; 4/7

THE NATURE AND PREVENTION OF AXLE TRAMP

by R. S. Sharp

HS-009 170 Fld. 5/15

THE ECONOMIC IMPACT OF ELECTRIC VEHICLES

by Bruce C. Netschert

National Economic Research Associates, Inc.

1971 7p 7 refs

Report no. SAE-710187

Presented at Automotive Engineering Congress, Detroit, Mich., 11-15 Jan 1971.

Complete overnight electrification of all ground transportation in the U. S. is assumed in order to provide a measure of the maximum possible impact of electric vehicles. The impact on the electric utility industry would be to increase total load by roughly one half; thus complete electrification of ground transportation at any realistic pace would pose no serious difficulties. The automobile manufacturing and ancillary industries, although subject to change, would find no serious difficulty in adapting. There would be serious impact on the petroleum industry, which would lose about half its markets. An especially bothersome problem would exist in public finance. Government revenues would be adversely affected without a transfer of the motor fuel tax funds to electricity consumed in transportation. It is unclear how such a transfer could be made feasible and equitable.

Engineers Proceedings v184 pt2A n3
p41-54 (1970)

An analog computer simulation of vibrations occurring with automobile rear axles under braking and accelerating conditions, commonly called "axle tramp," is described. These vibrations are shown to be self-excited, and the existence of limit cycles is demonstrated. The mode shapes corresponding to these limit cycles are described, and the mechanisms through which the self-excitation is possible are deduced. The ways in which the stability of the system and the limit cycles are affected by changes in the system design are indicated, and the longitudinal axle mounting stiffness is identified as a critical parameter, having a major influence on the stability. It is concluded that axle tramp can be eliminated by suitable attention to the design of the axle to body mounting.

Search terms: Rear axles/Vibration; Vibration/Computerized simulation; Braking/Vibration; Acceleration/Vibration; Vehicle stability/Vibration; Automobile design/Vehicle stability; Automobile design/Vibration; Equations of motion/Rear axles; Rear axles/Computerized simulation

HS-009 174 Fid. 5/18

EFFECT OF TRACTIVE FORCE ON DIRECTIONAL STABILITY AND CONTROLLABILITY OF VEHICLES

by Tadashi Okada; Takeo Sagishima

Toyo Kogyo Co. Ltd.

1969 18p 5 refs
Report no. SAE-690527

Presented at SAE Mid-Year Meeting, Chicago, Ill., 19-23 May 1969.

Theoretical calculation and experiments are made to make clear the transient response of a front wheel to a vehicle

reduced suddenly from a large stationary value, the turning radius decreases rapidly, and the stability and controllability of the vehicle decreases. This phenomenon is rarely seen in rear wheel drive vehicles. Experimental results reveal that a clue to this phenomenon lies in clarifying the reason for the difference between front and rear wheel drive in yaw velocity responses to the variation of tractive force. Good agreement between the experimental and the theoretical results suggests that the theoretical analysis will be sufficient to elucidate this phenomenon.

Search terms: Front wheel drives/Vehicle stability; Front wheel drives/Vehicle control; Equations of motion/Vehicle stability; Front wheel drives/Yaw; Front wheel drives/Vehicle handling; Front wheel drives/Rear wheel drives; Front wheel drives/Tests; Front wheel drives/Trac-

AVAILABILITY: SAE

HS-009 175 Fid. 5/18; 5/20

EFFECT OF VIBRATION ON THE PERFORMANCE OF OFF-ROAD VEHICLES

by Jo-Yung Wong

Carleton Univ.

1971 12p 10 refs
Report no. SAE-710224

Presented at Automotive Engineering Congress, Detroit, Mich., 11-15 Jan 1971.

An experimental study on the effect of vertical vibration on shearing characteristics between vehicle running gear and terrain under simulated operating conditions is described. It is found that the amplitude of dynamic load and slip velocity have a profound effect on the horizontal shearing force developed on vehicular ground contact area. In

velocity, the less the horizontal shearing force will be developed. The relationship between vehicle vibration and surface irregularity is also described. By integrating the results of the study on vehicle vibration excited by surface roughness with the experimental results concerning the effect of vibration on vehicle-terrain interaction, a general framework correlating vehicle vibration and vehicle performance with terrain conditions is established.

Search terms: Off the road vehicles/Vibration response; Vehicle soil interface/Off the road vehicles; Ground roughness/Off the road vehicles; Topographical factors/Off the road vehicles; Vehicle performance/Off the road vehicles; Slip/Off the road vehicles; Dynamic loads/Off the road vehicles; Shear stress/Off the road vehicles

AVAILABILITY: SAE

5/20 Trucks and Trailers

HS-009 176 Fid. 5/20

A CRITIQUE ON THE PERFORMANCE OF OFF-ROAD VEHICLES. FULL-SCALE TEST RESULTS AND PREDICTION. METHOD EVALUATION

by R. L. Pleuthner

Cornell Aeronautical Lab., Inc.

Jan 1969 77p 41 refs
Contract DAHCO4-67-C-0005
Report no. CAL-VJ-2330-G-54

A review of the literature pertaining to the prediction and experimental validation of off-road vehicle performance and an attempt to evaluate the various theories of performance prediction are presented. Categories of interest include drawbar pull, gradeability, soil resistance to motion, and speed. A total of 757 tests and corresponding predictions in all categories are reviewed and analyzed using a statistical measure to assess the

5/20 Trucks and Trailers (Cont'd.)

HS-009 176 (Cont'd.)

elements in soil bins are suggested for future study. Test methods are discussed and evaluated.

Search terms: Off the road vehicles /Vehicle performance; Tracked vehicles /Vehicle performance; Vehicle performance /Statistical analysis; Vehicle soil interface /Off the road vehicles; Vehicle performance /Reviews; Off the road vehicles /Reviews; Tracked vehicles /Reviews; Off the road vehicles /Speed; Drawbar pull /Off the road vehicles; Uphill performance /Off the road vehicles

5/20 Trucks and Trailers

HS-009 177 Fld. 5/20

TOW CAR TIPS

by C. W. Bendigo

Published in *Mobile Life* v11 n2 p26-7, 47-8 (Jun 1970)

Before buying a car to pull a super-deluxe travel trailer, a driver should be sure the car is powerful enough for the job. Six important features needed for this purpose and about a dozen desirable ones in addition deserve consideration.

Search terms: Travel trailers /Towing; Automobile power /Towing

HS-009 178 Fld. 5/20

PRODUCING A QUIET AND COMFORTABLE CAB

by Frank D. Eischen

Stolper Industries, Inc.

1968 13p

Report no. SAE-680587

Presented at SAE National Combined

Construction and Industrial Machinery, Powerplant, and Transportation meetings, Milwaukee, Wis., 9-12 Sep 1968.

Farm tractor cab design with respect to quiet, comfort, and convenience is discussed. The areas of visibility, accessibility, environmental control, and noise suppression are investigated. Various approaches to accomplish optimum conditions in these areas are analyzed, components are evaluated, and design recommendations are made.

Search terms: Farm tractor design; Farm tractor design /Visibility; Farm tractor design /Comfort; Farm tractor design /Noise control; Farm tractor design /Environmental factors; Tractor cab access /Farm tractors

AVAILABILITY: SAE

HS-009 179 Fld. 5/20

THE 500,000-MILE CHASSIS — WHAT IS IT WORTH?

by J. C. Paterson

Ryder System, Inc.

1969 8p

Report no. SAE-690551

Presented at National West Coast Meeting, Seattle, Wash., 11-14 Aug 1969.

The concept of a no-maintenance, heavy-duty, diesel tractor presented in this paper is based on the concept of component life expectancy. Design and engineering improvements of tractor systems and components are recommended for the development of a 500,000-mile, no-maintenance chassis. Such a chassis, together with electronic, computerized maintenance systems working on an on-demand basis, can be expected to generate savings averaging \$1448/tractor/year.

Search terms: Tractors /Maintenance;

Vehicle maintenance /Costs; Chassis /Maintenance; Repair costs /Mileage; Tractors /Service life

AVAILABILITY: SAE

HS-009 180 Fld. 5/20

OPTIMIZATION OF THE TRACTIVE PERFORMANCE OF FOUR-WHEEL-DRIVE OFF-ROAD VEHICLES

by Jo-Yung Wong

Carleton Univ.

1970 10p

Report no. SAE-700723

Presented at Combined National Farm, Construction and Industrial Machinery and Powerplant Meetings, Milwaukee, Wis., 14-17 Sep 1970.

In this paper, the basic tractive characteristics and the optimization of the performance of four-wheel drive off-road vehicles are analyzed from the point of view of tractive efficiency. It is found that the distribution of thrust and slip between the front and rear wheels has considerable effect on the efficiency of operation. Differences in theoretical speed and the type of coupling between the front and rear axles generally affect the thrust and slip distribution. It is shown that the optimum thrust distribution is that which can make the slips of the front and rear wheels equal. Only under circumstances will the tractive efficiency of a four-wheel-drive vehicle be a maximum. This requires that the thrust distribution should vary with the weight distribution of the vehicles as well as terrain and other conditions. It is pointed out that the inefficient distribution of thrust and slip also causes excessive tire wear. The analysis indicates that the development of a new type of interaxle coupling which can provide the optimum distribution of thrust and slip between driven axles is of practical importance.

Search terms: Off the road vehi-

cles/Traction; Off the road vehicles/Four wheel drives; Four wheel drive vehicles/Thrust; Front axles/Thrust; Rear axles/Thrust; Differentials/Thrust; Clutches/Thrust; Wheel slip control/Thrust; Four wheel drive vehicles/Slip; Axles/Differentials; Clutches/Front axles; Weight distribution/Thrust; Tire diameters/Slip; Tire wear/Thrust; Tire wear/Slip; Speed/Thrust; Speed/Slip

AVAILABILITY: SAE

S-009 181 Fld. 5/20; 5/4

THE DESIGN AND APPLICATION OF ELECTRICAL WIRING HARNESSSES FOR FARM MACHINERY

/ D. R. Dedow

General Motors Corp.

170 6p

Report no. SAE-700685

Presented at Combined National Farm, Construction and Industrial Machinery and Powerplant Meetings, Milwaukee, Wis., 14-17 Sep 1970.

Electrical wiring harnesses are most frequently designed as an afterthought. When all other designs are complete and components properly located, the electrical wiring is added. Today, with increased complexity, environmental hazards, buildability, serviceability, and ever increasing labor costs, it is becoming necessary to plan the wiring system in the early design stages of the vehicle.

Search terms: Farm vehicles/Electric system design; Electric system design; Electric system design/Environmental factors; Electric system design/Connectors; Electric system design/Cables; Electric systems/Reliability; Electric systems/Materials; Electric system design/Costs

AVAILABILITY: SAE

IS-009 182 Fld. 5/20; 5/4

by Jerry L. Hart

Detroit Automotive Products Corp.

1970 5p

Report no. SAE-700724

Presented at Combined National Farm, Construction and Industrial Machinery and Powerplant Meetings, Milwaukee, Wis., 14-17 Sep 1970.

The desirability of interaxle differentials in multi-axle vehicles is apparent. Currently, large off-highway haulers, rough terrain lift trucks, highway tractors, utility vehicles, and military vehicles are incorporating this concept. Additional interest has been expressed by the logging, construction, and mining vehicle manufacturers. The use of an interaxle differential results in improved performance of a working vehicle because it eliminates driveline windup. The No-SPIN and TANDEM-LOCK are unique in this application because they provide both differential action and full power to the axles when required. Detroit Automotive Products believes this to be a most exciting and promising area in future vehicle development.

Search terms: Off highway vehicles/Axles; Differentials/Axles; Tractors/Differentials; Military vehicles/Differentials; Construction vehicles/Differentials

AVAILABILITY: SAE

HS-009 183 Fld. 5/20; 5/18

ELASTOMERIC SUSPENSIONS WITH GEOMETRIC SPRING RATES FOR OFF-HIGHWAY VEHICLES

by James E. McClelland

Unit Rig and Equipment Co.

1970 23p 10 refs

and Powerplant Meetings, Milwaukee, Wis., 14-17 Sep 1970.

This paper describes an off-highway vehicle suspension using modular elastomer-bonded-to-metal impact cushioning pads. The modular impact pads are stacked inside telescoping struts which are connected between the axle and the frame. The rheology of the elastomer, and the cross-sectional shape of the pads give a geometric load vs. deflection curve; a near-linear spring rate vs. load curve, and a near-constant frequency at any level of load. These characteristics limit excessive deflections and increase the stability and controllability of the vehicle. The modular impact pads are self-damping, dissipating a large percentage of the applied energy, and require no auxiliary shock absorbers. A wide range of spring functions and damping functions are possible by utilizing different elastomers, pad shape, pad sizes, and numbers of pads. Initial cost and weight are less than conventional springs and struts. Maintenance costs are negligible and service lives of more than 25,000 operating hours have been recorded between overhauls.

Search terms: Suspension systems/Costs; Off the road vehicles/Suspension systems; Suspension systems/Elastomers; Struts/Padding; Spring rates; Spring damping; Springs; Damping; Vehicle stability; Axles; Deflection/Elastomers; Suspension systems/Service life; Rear suspension systems/Off the road vehicles; Front suspension systems/Off the road vehicles; Hitches/Padding; Hitches/Cushioning

AVAILABILITY: SAE

HS-009 184 Fld. 5/20

INDUSTRIAL CRAWLER TRACTORS AND LOADERS

by R. W. Johnson

5/20 Trucks and Trailers (Cont'd.)

HS-009 184 (Cont'd.)

Report no. SAE-700695

Presented at Combined National Farm, Construction and Industrial Machinery and Powerplant Meetings, Milwaukee, Wis., 14-17 Sep 1970.

Five basic industrial market demands for the tractor manufacturers were previously itemized. We believe that the various horsepower available for these tractors provide the customer with the opportunity to obtain a tractor properly sized for the job. High productivity has been accomplished through the use of a torque converter, a full power shift transmission, and a line of tractor equipment units specifically designed for these tractors. Maximum reliability has been achieved through thousands of hours of test time. Maximum value at a competitive cost was achieved through persistent efforts in value engineering. These efforts were augmented by a close working relationship with the Manufacturing Department. Lastly, good serviceability has been achieved by use of unit construction and by the adherence to the recommendations of our Test and Development Group.

Search terms: Tracked vehicles; Construction vehicles; Construction vehicle design; Tractor design; Torque converters/Tracked vehicles; Transmissions/Tracked vehicles; Tracked vehicles/Testing; Tracked vehicles/Horsepower; Tracked vehicles/Costs; Tracked vehicles/Torque

AVAILABILITY: SAE

HS-009 185 Fld. 5/20

A NEW APPROACH TO POSITIVE DRIVE SNOWMOBILE TRACKS

by William M. Haines

Gates Rubber Co.

1971 10p 8 refs

Report no. SAE-710231

Presented at Automotive Engineering Congress, Detroit, Mich., 11-15 Jan 1971.

This paper discusses the engineering principles of snowmobile locomotion and how they apply to the improved design of the involute lug drive track, a major step in the technological improvement of snowmobile performance. The relation between material, physical properties, construction methods, design, and track performance is developed. Fatigue characteristics of textile tensile cords are presented showing correlation to field and laboratory track testing. The exceptional polyurethane involute lug track and driver wheel characteristics are compared with conventional tracks. Problems associated with snowmobile track field testing and evaluation are discussed. The engine horsepower loss due to less oxygen at higher elevations is graphically compared to SAE elevation correlation factors. The peculiarities of alpine snow conditions are presented as the ultimate proving grounds for snowmobiles.

Search terms: Snowmobile tracks/Performance characteristics; Snowmobiles/Performance characteristics; Snowmobile design; Snowmobiles/Field tests; Snowmobiles/Laboratory tests; Polyurethane foams; Driving conditions/Altitude; Mountain driving/Snowmobiles; Driving conditions/Snow

AVAILABILITY: SAE

5/22 Wheel Systems

HS-009 186 Fld. 5/22

PAVEMENT WEAR DUE TO STUDDED TYRES MEASURED IN THE TEST ROAD MACHINE OF THE NATIONAL SWEDISH ROAD RESEARCH INSTITUTE

by Olle Andersson; Bengt Lilja; Ake Rosengren; Tore Astrom; Bjorn Orborn

Sweden. Statens Vagninstitut

1969 20p 84 refs
Report no. SR-83-A

The National Swedish Road Research Institute is for the present engaged on a rather extensive program for the study of pavement wear due to the influence of studded winter tyres. A considerable part of these studies is carried out in the test road machine of the institute. The present report will deal with the first nine test runs in this machine. The aim of these runs has been to compare various types of wearing courses with respect to their resistance to studded tyre wear, especially as regards manufacturing and composition parameters. The tyres used in the runs were ordinary passenger car tyres. The design of the road machine and the running conditions were such that the result cannot be quantitatively compared to the wear reached on streets and roads. The difference between the road machine conditions and the road conditions will be discussed later on. No special run aiming at a correlation between wear in the machine and wear on roads has been done but it is important that such a run be carried out later.

Search terms: Tire tests/Sweden; Studded tires/Tests; Studded tires/Pavement wear; Studded tires/Pavement tests

HS-009 187 Fld. 5/22

NON-DESTRUCTIVE TIRE ANALYSIS. A SMORGASBORD OF TESTING

by Ralph F. Wolf, Ed.

Published in *Rubber Age* v102 n4 p58-64 (Apr 1970)

A newly created cooperative nondestructive testing laboratory is described. The company invites rubber goods producers, concentrating initially on tire makers, to avail themselves of their non-destructive testing devices. Capabilities of ultrasonic, X-ray, infrared devices and holography are discussed briefly. Benefits of the program are stated as development of a

better method of determining safe tire performance; as means of gaining increased acceptance of results by both government and public; as providing more complete evaluation; as reducing costs; and as an insurance for developing tests.

Search terms: Nondestructive tests /Industry government cooperation; Nondestructive tests /Tires; Nondestructive tests /Coordination; Ultrasonic tests /Tires; X rays /Tire tests; Infrared scanning /Tire tests; Holographic interferometry /Tire tests; Nondestructive tests /Tire safety; Nondestructive testing /Evaluation; Nondestructive testing /Costs; Nondestructive testing /Research

HS-009 188 **Fld. 5/22**

READY FOR WINTER? CHOOSING THE TYRE

Anonymous

Published in *Autocar* v131 n3849 p17-20 (20 Nov 1969)

Title appears in table of contents as:
Winter Equipment: Choosing the Tyre.

Recommendations for tires and chains for winter driving conditions are presented. A tire combination guide is displayed. Costs for studs and chains are compared.

Search terms: Tire chains /Winter driving; Crossply tires /Winter driving; Radial tires /Winter driving; Snow tires /Winter driving; Bias belted tires /Winter driving; Steel tires /Winter driving; Studded tires /Winter driving; Tire studs /Costs; Tire chains /Costs; Tire pairing /Safety

HS-009 189 **Fld. 5/22**

THE ACCURACY OF AIR TOWER PRESSURE GAGES IN SUBURBAN WASHINGTON, D. C.

National Bureau of Standards

Dec 1969 11p
Report no. NBS-TN-512

A survey of 50 air tower pressure gages in service stations of suburban Washington, D. C., was performed. Results showed that a motorist using these towers has only a 20 percent chance of inflating his tires within ± 1 psi of the pressure indicated by the tower's gage. It is shown that a calibration of the tower gages would reduce the standard deviation of the obtained pressure to 0.5 psi.

Search terms: Tire inflation pressure /Gauges; Service stations /Gauges; Service stations /Compressed air; Compressed air /Gauges; Towers /Compressed air; Tire inflation pressure /Tests

AVAILABILITY: GPO \$0.25

HS-009 190 **Fld. 5/22**

DESTRUCTIVE TESTING OF ALUMINUM WHEELS

by Roy Richter

Cragar Industries

1970 5p
Report no. SAE-700444

Presented at SAE Mid-Year Meeting, Detroit, Mich., 18-22 May 1970.

The increased popularity of the cast nonferrous styled wheel has created a need for performance testing of these wheels. Styled wheels are normally used on the same applications as standard OEM steel wheels so they should be expected to pass the same test requirements. However, the difference in physical properties of the two materials dictates a change in test load as well as a redesign in some commonly accepted test equipment. Testing and performance of aluminum wheels are discussed.

Wheels /Materials tests; Wheels /Aluminum; Wheels /Steels; Wheel design; Wheels /Performance tests

AVAILABILITY: SAE

HS-009 191 **Fld. 5/22; 4/7**

THE VERTICAL RESPONSE CHARACTERISTICS OF THE NON-ROLLING TYRE

by J. A. Overton; B. Mills; C. Ashley

Ford Motor Co. Ltd.; Birmingham Univ.

Published in *Institution of Mechanical Engineers Proceedings*, 1969-70 v184 pt2A n2 p25-40

14 refs

Due to the complexity of the dynamic behavior of pneumatic tires, a preliminary study is carried out to determine experimentally the vertical response characteristics of the non-rolling tire. A measurement technique based on the concept of mobility is used to show that the tire exhibits a fundamental rigid body mode as well as higher flexural modes of vibration. The results show that there are marked differences between the two types both in the character of the response and the level of damping. The commonly used mathematical model to represent the fundamental mode is shown to be inadequate. A viscoelastic model is proposed to describe this mode of vibration, which includes frequency-dependent stiffness and damping coefficients. The theory is further developed to predict motion transmissibility across the tire from the input mobility data.

Search terms: Mathematical models /Tire characteristics; Tire vibration /Mathematical models; Damping /Tire characteristics; Viscoelasticity /Tire characteristics; Rigidity /Tire characteristics; Stiffness /Tire

THE LOAD DEPENDENCE OF LABORATORY ABRASION AND TIRE WEAR

by K. A. Grosch; A. Schallamach

Published in *Rubber Chemistry and Technology* v43 n4 p701-13 (Jun 1970)

Reprinted from *Kautschuk und Gummi Kunststoffe* v22 (1969).

The theory on the wear of slipping wheels has been modified to assess the effect of a nonlinear load dependence of sliding abrasion on tire wear, with particular reference to its own load dependence. The theoretical predictions have been compared with experimental results obtained in the laboratory and on the road. The first outcome of this investigation is that non-proportionality between sliding abrasion and load has relatively little effect on the load dependence of tire wear, which is almost entirely governed by the load dependence of the contact length, unless the inflation pressure is very low. The modified theory on the wear of slipping wheels predicts near proportionality at constant slip between wear in crab walk and side force and the existence of a severity effect on tire wear ratings.

Search terms: Wheel slip /Tire wear; Tire loads /Wheel slip; Tire loads /Tire wear; Wheel slip /Laboratory tests; Wheel slip /Road tests; Tire wear /Laboratory test; Tire wear /Road tests; Abrasion tests /Tire wear; Wheel slip /Mathematical models

HS-009 193 Fld. 5/22

SERVICING, SELLING WINTER TIRES

Anonymous

Published in *Motor* (New York) v135 n1 p38-41 (Jan 1971)

given. Only new or retreaded snow tires should be studded. Missing studs should not be replaced, nor studs put in used snow tires with stud holes molded in the tread. Studded tires should not be rotated. Winter tires should be stored on their sidewalls away from oil, water, and electric motors. The introduction and advantages of winter studded tires on all four wheels is mentioned.

Search terms: Snow tires; Studded tires; Tire storage

5/23 Windshield Related Systems

HS-009 194 Fld. 5/23

THE FUTURE OF HYDRAULIC-POWERED WIPER MOTORS

by Richard A. Batt

Trico Products Corp.

1971 9p
Report no. SAE-710258

Presented at Automotive Engineering Congress, Detroit, Mich., 11-15 Jan 1971.

The hydraulic-powered wiper motor has been used for ten years in top car line wiper sets with wiper blades up to 20 in. long. The production power source is the power steering pump, but the automatic transmission hydraulic pump and a separate hydraulic pump are also recommended for further consideration. The hydraulic-powered wiper motor has an abundance of torque, smooth operation with cushioned reversal, variable continuous speeds, car-life endurance, parking to right or left, readily changeable arcuate travel, and compactness. It can be made to provide intermittent wipe and can incorporate a washer pump with synchronized fluid delivery. A new hydraulic-powered wiper motor has been developed that is more economical and smaller in size, has snap-in connections for the hydraulic lines, and is available

available to the wiper engineer for future applications to meet the need for more power, intermittent-wiping action, washer systems integrated with the wiping system, heavy-duty service-free commercial wiper power, and auxiliary power units. The hydraulic-powered wiper motor has truly come of age as a fourth-generation wiper and is ready for a promising future.

Search terms: Hydraulic design factors /Windshield wipers; Hydraulic design factors /Windshield washers; Motors /Hydraulic design factors; Power supplies /Windshield wipers; Power supplies /Windshield washers

AVAILABILITY: SAE

NHTSA DOCUMENTS

NHTSA Accident Investigation Reports

HS-800 430 Fld. 5/18; 5/20; 4/7; 2/4

THE SKIDDING OF VEHICLES. A DYNAMIC ANALYSIS. A DYNAMICAL ANALYSIS OF A TOWED TWO-WHEEL TRAILER

by Edward A. Saibel; Shang-Li Chiang

Carnegie-Mellon Univ.

Mar 1971 26p 7 refs
Contract FH-11-6090
Report no. 4

The towed trailer method for skid resistance measurements is a practical one for characterizing the friction characteristics of highway pavements and has been standardized by the ASTM. This paper presents a mathematical model of the trailer which includes roll, pitch, and vertical motion. The skid resistance calculated by using this model gives an excellent check on the standard ASTM skid resistance calculated by using sponse time and damping effect after

dimension of trailer, stiffness of suspension system, and tire pressure to skid resistance can also be examined.

Search terms: Pavement skid resistance/Test equipment; Trailers/Mathematical models; Trailers/Towing; Equations of motion/Trailers; Roll/Trailers; Pitch/Trailers; Suspension systems/Trailers; Tire inflation pressure/Trailers; Vehicle size/Trailers; Friction tests/Pavement skid resistance; Damping/Pavement skid resistance; Time factors/Pavement skid resistance

AVAILABILITY: NTIS

HS-800 472 Flid. 2/0; 1/3; 4/6; 4/3

DEVELOPMENT OF HIGHWAY SAFETY STATISTICAL INDICATORS

Operations Research, Inc.

Mar 1971 92p
Contract FH-11-7505
Report no. TR-653

The study objective was to develop a set of statistical indicators to evaluate the national highway safety situation. An economic loss model relating physical damage from crashes to the resultant monetary costs incurred by the victims was developed. The crash data were stratified into exposure classes based upon the significant trends influencing the highway crashes and resultant economic loss. From the foregoing data base, two index measures were developed, (1) a value index to measure the level and change in economic loss from a base period, and (2) a real cost index, adjusted for price change and vehicle-miles traveled, to measure the trend of highway crashes and injuries in terms

Search terms: Highway safety/Statistical analysis; Accident costs/Mathematical models; Injury costs/Mathematical models; Vehicle mileage/Accident costs; Fortran/Accident costs; Insurance costs; Insurance claims/Accident costs; Highway safety/Wisconsin; Injury severity index; Accident severity index; Damage severity index; Accident types/Costs; Urban accidents/Costs; Rural accidents/Costs; Driver sex/Accident costs; Driver age/Accident costs

AVAILABILITY: NTIS

HS-810 159 Flid. 5/0; 4/4

SAFETY MEASURES FOR MOTOR VEHICLES. THE ROLE OF THE NATIONAL HIGHWAY SAFETY BUREAU

by Catherine D. August

National Highway Safety Bureau
1970 10p

Prepared for presentation at seminar sponsored by the Motor Vehicle Safety Group of Eta Kappa Nu, Boston, Mass., 26 Feb 1970.

A brief history of the federal role in highway safety is given. The history of motor vehicle safety performance standards is dealt with in greater detail. Standards were categorized as related to the pre-crash, crash, or post-crash phase. The first covers crash prevention elements; the second, crash injury reduction elements; and the third concerns integrity and security of fuel tanks to minimize fire hazards after collision. Evaluating the effectiveness of the standards is difficult since only about 20% of the vehicles on the road meet them. However, some benefits have been observed, including: the rate of climb in fatalities slowed from an average of 6.9% for five years preceding 1966 to 2.1% for

has dropped from 7.0 to 5.7. Future plans include: tightening requirements of existing standards; improving crash survivability; developing the experimental safety car.

Search terms: Safety programs/Federal role; Precrash phase/Safety standards; Crash phase/Safety standards; Postcrash phase/Safety standards; Fatality rates; Injury rates; Fatality prevention; Injury prevention; Safety cars

HS-820 156 Flid. 5/17

MOTOR VEHICLE SAFETY DEFECT RECALL CAMPAIGNS FROM JANUARY 1, 1971 TO MARCH 31, 1971 REPORTED TO THE NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION BY DOMESTIC AND FOREIGN VEHICLE MANUFACTURERS

National Highway Traffic Safety Administration

1971 14p

This tabulation of safety defect recall campaigns includes the make and model, model year, description of the defect requiring manufacturer's corrective action, number of vehicles recalled, date of notification and identification number. Automobiles, trucks, school buses, trailers, and tractors are included.

Search terms: Automobile recall campaigns/Statistics; Truck recall campaigns/Statistics; Trailer recall campaigns/Statistics; Tractor recall campaigns/Statistics; School bus recall campaigns/Statistics; Defect correction/Statistics; Recall campaigns/Statistics

AVAILABILITY: GPO \$0.15



executive summary

SYNOPSIS OF A RECENTLY RELEASED NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION RESEARCH REPORT

CITY OF NEW YORK EMERGENCY AMBULANCE DEMONSTRATION PROJECT

The purpose of the project was to develop and demonstrate the application of scientific management tools for planning and control of emergency ambulance service, and possibly other applicable services, in the City of New York. This included the development of a mathematical model to stimulate ambulance service operations; and, the design of a geographic information system to incorporate computer generated methods for mapping ambulance calls. The system, and all it encompasses would be made readily available for use by other urban areas.

Contract No. FH-11-6930
City of New York
Office of the Mayor
Office of Administration
New York, New York

Award Amount: \$150,000.00
Report of Project Due: 5/31/70
Report Rec'd.: 8/10/70
Release Date: 11/3/70

DOT/HS-800 307 - Part I: Demonstration Project - PB - 195 053
DOT/HS-800 308 - Part II: Dispersal of Emergency Ambulances in the City of New York: A Demonstration and Analysis - PB-195 054

BACKGROUND

New York's emergency ambulance service is available to almost ten million persons daily. The service operates 24 hours every day of the year and responds to more than a half million calls annually. A constantly increasing workload and the need for operational improvements dictated that the City take advantage, to the fullest extent possible, of modern systems and operations research techniques in the planning and management of the ambulance system. The demand for this service growing at such a formidable pace, it could outstrip the supply capability unless the system undergoes considerable expansion or is improved so that it will yield higher performance at no great additional public expense. The dispersal experiment described in the report seeks to demonstrate the viability of pursuing the overall objective.

hospitals located throughout the city. Additional ambulance service is supplied by 31 voluntary hospitals on an annual contract basis, also under the supervision of the Hospitals Department Transportation Division. These voluntary hospital ambulances number 44. Total ambulances in the system number 109. Responsiveness of these vehicles could be much improved if their deployment patterns were in accord with the observed patterns of calls received for their service.

In general, each hospital, municipal or voluntary, operates within an assigned geographic area in which the hospital is located. Assignments are made by the Ambulance Dispatch Section of the Police Department Communications Division (Central Communications) which responds to the 911 emergency telephone number, and which relays requests for emergency ambulance service to the appropriate hospital. This system is based on a fixed assignment basis.

ambulance service in depth. This area was chosen because it is one of the heaviest call areas in the City, and complaints of delays in response were being received. The Department of Hospitals had proposed the establishment of a "satellite" or outpost ambulance station to be located in a dense call area, claiming that response time would then be reduced 50 percent.

It at first appeared that such a substantial improvement could be achieved. However, a closer look revealed that not all response time is dependent upon travel time. Other factors include numbers of ambulances in the system, their locations and availability at any point in time (as well as their base locations), location of the hospitals, frequency of calls, and time spent in dispatching, picking up and dropping off patients. In order to take all of these into account and to enable the City to experiment with varying policies without actually purchasing vehicles or physically changing the system in any way until the effects of the changes could be analyzed, a mathematical model of the Kings County Hospital district operations was developed and different configurations (numbers and base locations) of ambulances were simulated in a computer.

This marked the first time that the City of New York had utilized computer simulation as an aid to decision-making. The results demonstrated that, while the improvement magnitude was less than the original "top of the head" estimate, changes in the numbers and deployment of Kings County Hospital's emergency vehicles would result in improved service. The configuration demonstrated by the model to be the most effective was implemented for Kings County Hospital and the Department of Hospitals was anxious to apply this tool to planning in other areas in the City.

MAJOR FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

The project was divided into three major areas:

1. The simulation model
2. Field experimentation
3. The geographic information system (GIST)

Simulation Model

- With the use of the capabilities found in GIST, the generalized model system can be employed to simulate the operations of any desired ambulance service area. It will predict both the direction and magnitude of change in vehicle response time resulting from a given change in vehicle base locations and numbers of vehicles in the emergency ambulance system.
- The model might also be used to study the effects of such policy changes on other vehicle systems. These need not necessarily be emergency services but rather any system in which the deployment of a fleet of vehicles should be in accord with the observed pattern of demand for its services.

Field Study

- A field demonstration was conducted in which certain ambulances of the Emergency Ambulance Service were removed from their traditional hospital garage setting and located individually in areas of high call demand.
- The primary purpose of the experiment was to calibrate and validate the computer simulation model. In addition the test had the two-fold purpose of determining whether emergency ambulances could operate under such semi-autonomous conditions and, whether such positioning in places of greatest need would yield improvements in performance.
- Performance data was gathered prior to dispersal with ambulances operating in the normal garage based pattern. This furnished a basis with which to compare identical data gathered when ambulances were dispersed. Both "before" and "after" data were used to calibrate and validate the simulation model.
- Test results showed affirmatively that ambulance dispersal was feasible and further demonstrated that a dispersed ambulance arrived at the scene of accident, injury, or sickness in a shorter span of time than its conventionally hospital based counterpart.
- Dispatch delay was substantially reduced. The average response time for all dispersed ambu-

before dispersal. In addition, there was an increase of 46 percent in the fraction of calls whose response time was less than 10 minutes. Regardless of which areas dispersed ambulances serviced, dispersed ambulance response time averaged less than the existing average response time for the area.

- Relocation of ambulances to areas of high call density did not reduce ambulance availability to other areas. Although stationed at curbside locations in areas apart from the hospital, these ambulances can respond to calls, no matter where the location.
- Transfer of patients (non-emergency service) can be restricted through proper monitoring procedures and can even be limited to specially designated ambulances.
- In general, the test demonstrated the feasibility of ambulance dispersal. There was no loss of control of the dispersed ambulances; they were more available for assignment than under the traditional dispatch system; and their effectiveness, as measured by decreased response times, was improved. In addition, personnel involved, both ambulance crews and dispatch personnel, demonstrated their ability to adjust to the new procedures.
- In certain aspects of the demonstration optimum performance was not achieved (dispatch, back-up supervision, etc.). However, in all cases, such deficiencies as were noted could be overcome easily by additional planning and with more attention to training of personnel.
- The dispersal system and dispatching procedures have already been implemented in several key areas in the City. Extension of the pattern to achieve Citywide dispersal operation, as well as implementation of the related recommendations, is now in progress.

Geographic Information System (GIST)

- Through its address matching programs and files, this system can provide computer generated co-ordinates for a given address. These are used for input to the simulation model and also as input to GIST's mapping capabilities. The map is then

The following recommendations are made as a result of this successful experiment:

- Dispersal of ambulances should be effectively implemented in all high demand areas of the City.
- Objectives should be established for response times, and ambulance performance should be measured against these objectives.
- Improved dispatching techniques should be instituted whereby the dispatch office could:
 - constantly monitor ambulance availability, location and performance and make assignments thereby;
 - follow an orderly, pre-established logistics plan for sequential back-up in all areas.
- The concept of ambulance districting should be abandoned insofar as assignment of ambulances is concerned.
- A system of supervision in the field should be established on an around-the-clock basis to replace the limited supervision presently in force.
- Sites at which to locate dispersed ambulances should be carefully chosen to fulfill all the operational requirements of such a station and should, insofar as possible, be at existing city or quasi-public installations so that the improvements inherent in dispersal should not be offset by prohibitive rental costs.
- A supply service (medical and automotive) should be instituted within the emergency ambulance service. This service would be compatible with the requirements of an around-the-clock service and would free ambulances from dependence upon individual hospitals.
- A consolidated, all inclusive, call report form be devised and a management information system established to serve all levels of supervision in the service.

The Contract Manager has certified that the contractor's (City of New York) project has been satisfactorily completed and that all contractual obligations have been met.

Availability: The above reports may be ordered in paper copy (PC) or microfiche (MF) from NTIS. Order DOT/HS-800 307 or PB-195-053 and DOT/HS-800 308 or PB-195-054.

Magnetic Tape Availability: NTIS

DOT/HS-800 484 (Direct tie-in to reports DOT/HS-800 307 and DOT/HS-800 308 mentioned in synopsis).

Contents of Tape:

1. Appendix D to the project report entitled, "Function Generator Program Listing"
2. Appendix F to the project report entitled, "Call (Transaction) Tape Generator Program Listing"
3. Appendix H, entitled:
"Ambulance Service Simulation Model Program Listing"
4. Appendix I, entitled:
"Elmhurst Hospital Simulation Output"

Layout of Tape:

1. Blocking factor: Unblocked card images
2. BPI: 800
3. Tracks: 9
4. Language: FORTRAN - GPSS
5. System: IBM 360
6. Records length: 80 card columns (1 x 80)
7. Format of record: Instructions, Source listing
8. Operating System: DOS
9. Last record on tape if DOS: "End"
10. Date: April, 1970

To order tape, order DOT/HS-800 484 from NTIS

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